

# MINING WORLD

## The Sydvaranger Taconite Story

See Page 49

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220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041, 1042, 1043, 1044, 1045, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1065, 1066, 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, 1076, 1077, 1078, 1079, 1080, 1081, 1082, 1083, 1084, 1085, 1086, 1087, 1088, 1089, 1090, 1091, 1092, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 1178, 1179, 1180, 1181, 1182, 1183, 1184, 1185, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1193, 1194, 1195, 1196, 1197, 1198, 1199, 1200, 1201, 1202, 1203, 1204, 1205, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217, 1218, 1219, 1220, 1221, 1222, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, 1263, 1264, 1265, 1266, 1267, 1268, 1269, 1270, 1271, 1272, 1273, 1274, 1275, 1276, 1277, 1278, 1279, 1280, 1281, 1282, 1283, 1284, 1285, 1286, 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 1450, 1451, 1452, 1453, 1454, 1455, 1456, 1457, 1458, 1459, 1460, 1461, 1462, 1463, 1464, 1465, 1466, 1467, 1468, 1469, 1470, 1471, 1472, 1473, 1474, 1475, 1476, 1477, 1478, 1479, 1480, 1481, 1482, 1483, 1484, 1485, 1486, 1487, 1488, 1489, 1490, 1491, 1492, 1493, 1494, 1495, 1496, 1497, 1498, 1499, 1500, 1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514, 1515, 1516, 1517, 1518, 1519, 1520, 1521, 1522, 1523, 1524, 1525, 1526, 1527, 1528, 1529, 1530, 1531, 1532, 1533, 1534, 1535, 1536, 1537, 1538, 1539, 1540, 1541, 1542, 1543, 1544, 1545, 1546, 1547, 1548, 1549, 1550, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560, 1561, 1562, 1563, 1564, 1565, 1566, 1567, 1568, 1569, 1570, 1571, 1572, 1573, 1574, 1575, 1576, 1577, 1578, 1579, 1580, 1581, 1582, 1583, 1584, 1585, 1586, 1587, 1588, 1589, 1590, 1591, 1592, 1593, 1594, 1595, 1596, 1597, 1598, 1599, 1600, 1601, 1602, 1603, 1604, 1605, 1606, 1607, 1608, 1609, 1610, 1611, 1612, 1613, 1614, 1615, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1626, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1635, 1636, 1637, 1638, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648, 1649, 1650, 1651, 1652, 1653, 1654, 1655, 1656, 1657, 1658, 1659, 1660, 1661, 1662, 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691, 1692, 1693, 1694, 1695, 1696, 1697, 1698, 1699, 1700, 1701, 1702, 1703, 1704, 1705, 1706, 1707, 1708, 1709, 1710, 1711, 1712, 1713, 1714, 1715, 1716, 1717, 1718, 1719, 1720, 1721, 1722, 1723, 1724, 1725, 1726, 1727, 1728, 1729, 1730, 1731, 1732, 1733, 1734, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1743, 1744, 1745, 1746, 1747, 1748, 1749, 1750, 1751, 1752, 1753, 1754, 1755, 1756, 1757, 1758, 1759, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775, 1776, 1777, 1778, 1779, 1780, 1781, 1782, 1783, 1784, 1785, 1786, 1787, 1788, 1789, 1790, 1791, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148

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## SAMPLE LOCATIONS

### WORLD MINING (OVERSEAS EDITION)

	Page
<b>The Sydvaranger Story</b>	
Introduction	47
Geology: Ore Body Is Quartz-Banded Magnetite In High-Dip Metamorphosed Sediments	
—by Jens A. W. Bugge	52
Mining: Modern U. S. Equipment Moves 3,600,000 Tons of Hard Ore and Waste Annually	
—by Ulf Smith Meyer	54
Primary Crushing: Specially Designed 54-Inch U. S. Built Gyratory Reduces Tough Abrasive Ore To 6-Inch Size	57
Milling: Circuit Features Concentrate Regrind Before Two-Stage Magnetic Cleaning	
—by Marcus Digre	60
Mill Control: Milling Circuit Features Close Control To Insure High Recovery and a Premium Concentrate	
—by Arne Stavang	67

## MINING WORLD

Electric Power: Hydro and Steam Plants Serve as Distribution System Designed to Handle Fluctuating Loads	
—by Asbjorn Borsting	69
Maintenance: Large Machine Shops and Huge Spare Parts Inventory Make Any Repair Easy	74
Future: Pelletizing Plan Underway: Underground Mining Planned in Future	76

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At Bessemer Limestone & Cement Co., Bessemer, Pa., one McCarthy unit (above) averages 90 ft. per hour, drilling through hard blue shale and sand rock 34 ft. deep. Blast holes are drilled on 18-ft. centers. Two men handle the whole job, including setup and moving. McCarthy drills operate with gasoline, diesel or electric power units . . . on all types of mounts. McCarthy "money-savers" can work for you. See your nearby distributor or write Salem Tool direct for further information.



THE SALEM TOOL CO.

801 S. ELLSWORTH AVE.

SALEM, OHIO - U. S. A.

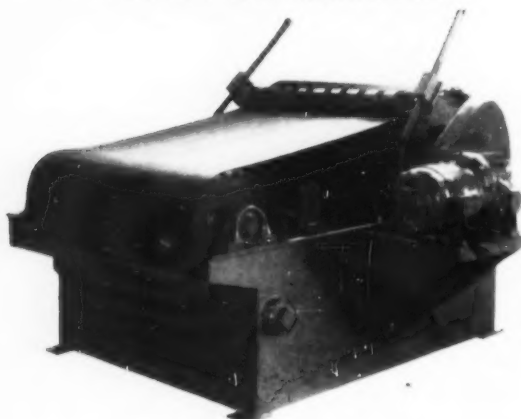
# DINGS MAGNETIC SEPARATOR CO.

**"In the magnetic  
concentration of taconite ore  
— we're old hands  
at being first!"**

***Take a look at this list of Dings firsts...***



THIS IS A DINGS DRUM-TYPE SEPARATOR—THE TYPE USED AT THE SYDVARANGER TACONITE PLANT.



DINGS BELT TYPE SEPARATOR.



- 1** A true high-intensity electro drum type separator for cobbing of the rod mill product at capacities permitting the use of the lowest number of magnetic separators at this point in the concentrating circuit.
- 2** The first high capacity Alnico cobbing drum to equal the performance of electro units.
- 3** Full width electro and permanent drum separators. These "wide" drum units have made possible capital savings of  $\frac{1}{3}$  in commercial plants.
- 4** A 24" diameter three-pole finisher magnetic separator that has proven to be extremely economical and efficient for finisher operations.
- 5** The first high-intensity belt type separator for cobbing rod mill product—a high capacity unit that keeps separator requirements as economical as possible.
- 6** The design and manufacture of special demagnetizing coils for de-flocculation of taconite concentrates prior to classification . . . and magnetizing coils for flocculation of taconite concentrate.

Since 1943 these Dings developments have paralleled growth and progress in taconite processing industry—have often made that progress possible.

Dings manufactures a complete line of drum and belt type magnetic separators for all phases of taconite concentration, ranging from rod mill cobbing to finisher work on -325 mesh concentrate. Just write for more information.

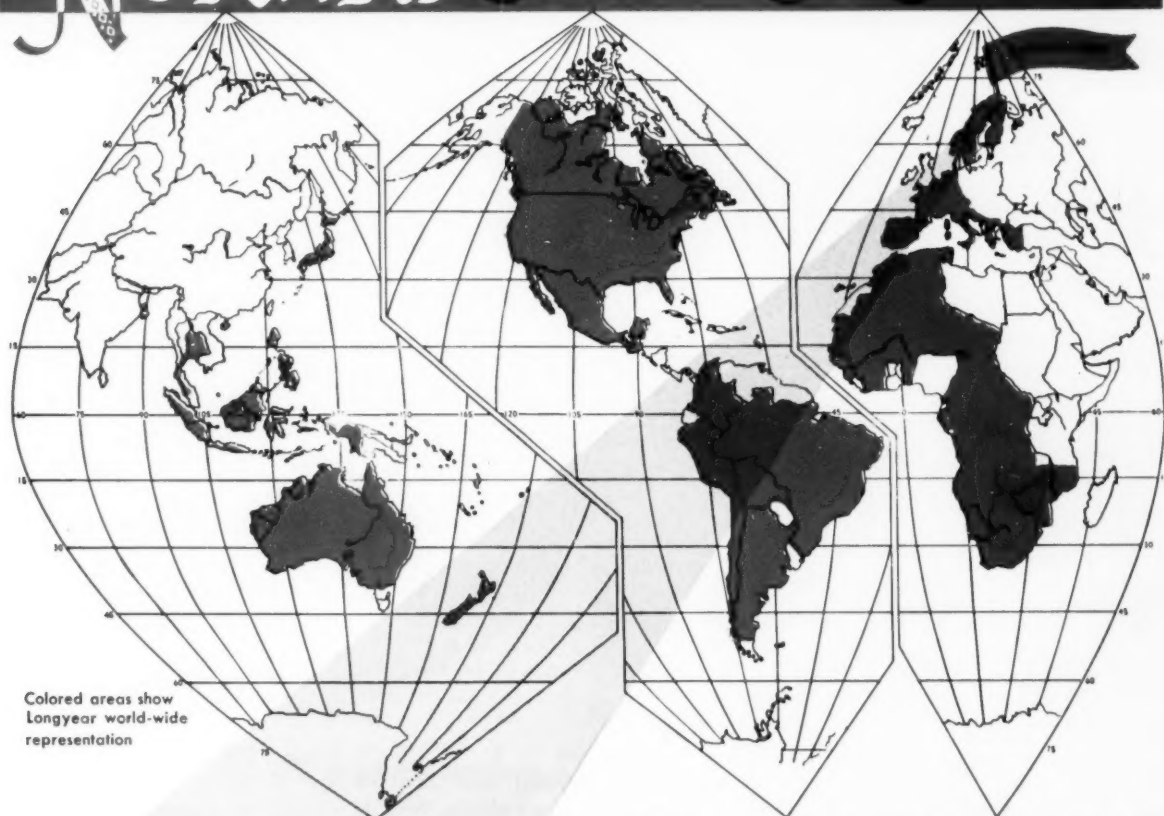
WC253

**DINGS MAGNETIC SEPARATOR COMPANY**

4719 W. Electric Ave., Milwaukee 46, Wis.



# NORWAY—*forerunner of the future*



## ...In the spotlight this month is SYDVARANGER



One of the Longyear Junior Straitlines used in the Sydvaranger operation

*Cores  
Tell  
The Story...*

North of the Arctic Circle, Longyear diamond core drills are being used in successful exploration by the Sydvaranger Mines—the world's first commercial taconite operation. The reliability of Junior Straitline Drills and the efficiency of the new "L" Series Core Barrels have provided maximum core recovery with low operating and maintenance costs.

It was in Norway, too, that Longyear contracted for its first shaft outside the United States. Since then, Longyear's mining division has performed similar work in many parts of the world, one of the most recent being the largest underground excavation to date in the United States for the storage of liquid petroleum gas.

Diamond core drilling under contract—another world-wide service—is available with trained crews and modern, efficient drills and equipment. Economical and successful core recovery is a Longyear tradition in all parts of the world, even under the most adverse conditions.

Longyear's geological division has also carried out projects around the globe, and is currently engaged in an extensive mapping survey of Portuguese East and West Africa.

Longyear's products and services combine to give you complete facilities from one company . . . unequalled in the exploration field. *We invite your inquiries.*

In U.S.A.  
**E. J. LONGYEAR COMPANY**  
Minneapolis 2, Minn.

# Longyear

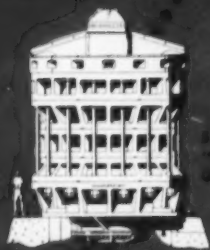
In Canada  
**CANADIAN LONGYEAR LTD.**  
North Bay, Ontario

**DIAMOND CORE DRILLS • CONTRACT CORE DRILLING  
GEOLOGICAL AND MINING ENGINEERS AND CONSULTANTS**

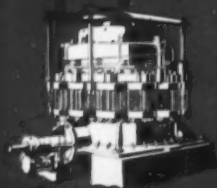
— REPRESENTATIVES IN PRINCIPAL MINING CENTERS OF THE WORLD —

*Another Prominent Mining Company Selects*

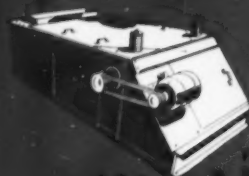
**NORDBERG** *throughout*



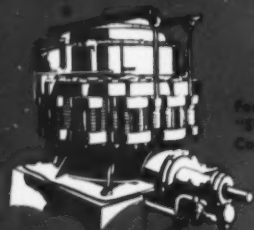
54" super-heavy  
"SYMONS" Primary  
Gyratory Crusher.



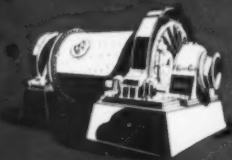
Seven 7-foot super-heavy  
"SYMONS" Standard  
Cone Crushers.



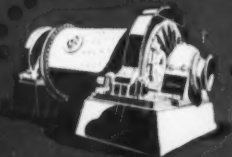
Four 5' x 8' "SYMONS"  
Rod Deck Screens.



Four 7-foot super-heavy  
"SYMONS" Short Head  
Cone Crushers.



Two 10' x 12' Nord-  
berg (Primary)  
wet grinding  
Mills.



Four 10' x 12' Nord-  
berg (Secondary)  
wet grinding  
Mills.

## SYDVARANGER

One of the world's great  
post-war mining operations  
employs **NORDBERG**  
Crushing, Screening and Grinding  
machinery for reduction of  
**TACONITE - IRON ORE**

Completely rebuilt after total destruction during World War II, the Sydvaranger iron ore crushing and concentrating plant at Kirkenes, Norway, far above the Arctic Circle, one of the world's outstanding pioneer taconite operations, uses Nordberg machinery for all stages of Crushing, Screening and Grinding. The ore is an extremely hard, laminated magnetite, quite similar to the American magnetic taconites of the Lake Superior district.

Based on years of experience with Nordberg machinery, and after thorough study of their exacting requirements, Sydvaranger selected

Nordberg throughout and installed a Symons extra heavy duty cast steel 54" Gyratory Crusher for primary breaking . . . six 7' Superheavy Symons Cone Crushers for secondary and tertiary crushing . . . four 5' x 8' Symons Rod Deck Screens for scalping service . . . and to obtain a high grade of concentrate, six 10'-8" x 17' Nordberg Heavy Duty Primary and Secondary Ball Mills.

Thus, at Sydvaranger . . . as in most of the great ore and industrial mineral operations the world over . . . you'll find Nordberg Machinery the first choice of experienced operators.

*Write for literature on the equipment you need.*



**NORDBERG MFG. CO.**  
MILWAUKEE 7, WISCONSIN

NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE  
MEXICO, D. F. • LONDON • TORONTO • JOHANNESBURG

M551-R2

# NORDBERG

*Machinery for processing  
ores and  
industrial minerals*



"SYMONS"  
PRIMARY  
CRUSHERS



"SYMONS"  
CONE  
CRUSHERS



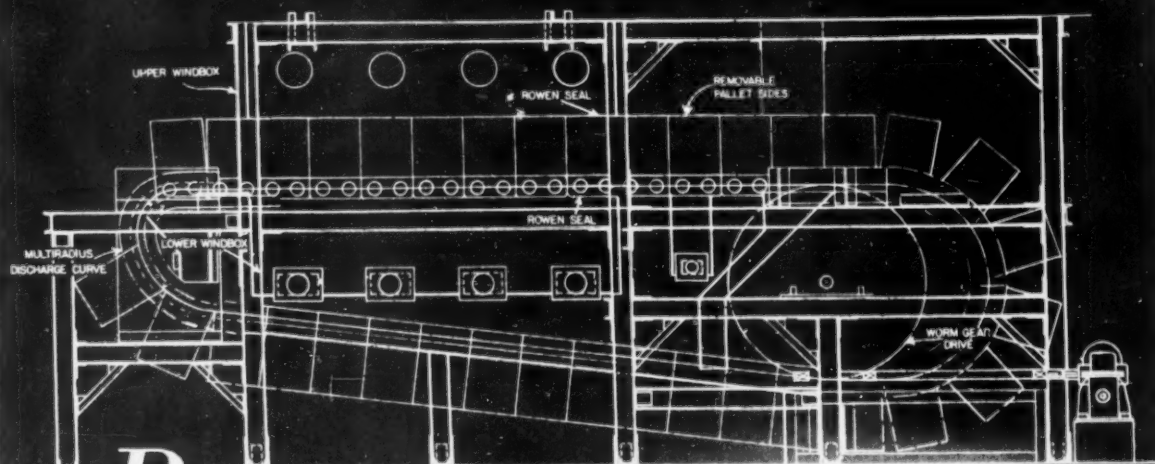
"SYMONS"  
VIBRATING SCREENS  
and GRIZZLES



GRINDING  
MILLS



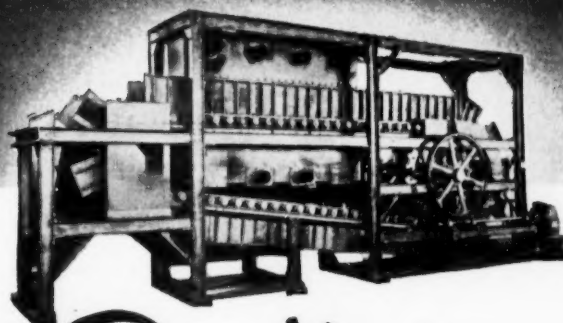
DIESEL  
ENGINES



## Research in TACONITE

aided by

# NEW DWIGHT-LLOYD<sup>®</sup> Pilot Machine



The new Dwight-Lloyd Pilot sintering machine is an ideal research unit for determining economical processing of ores and ore concentrates under controlled production line conditions. These machines are relatively low cost units designed for sintering, roasting, agglomerating, calcining and heat treating ores, ore concentrates and other materials. Pilot units are now in use in experimental heat treating of pelletized taconite concentrates for blast furnace charge.

The new Dwight-Lloyd Pilot sintering machine provides features in its design to enable research personnel to experiment with the many techniques now under investigation. The unit can be operated by down draft or up draft, or in combination. Gases may be recirculated for full heat recuperation or gas enrichment. Upper and lower windboxes can be compartmentized to give any recirculation setup. Pallet sides are removable and can be furnished in varying heights to enable investigations involving various bed depths.

These extremely flexible prototypes of the production size Dwight-Lloyd sintering machines give re-

search and project engineers an important new tool which will help them determine the most economical and efficient process requirements for full scale production use.

The Sintering Machinery Corporation has wide experience in the design and manufacture of sintering and pelletizing equipment for specialized applications. We welcome the opportunity to discuss your problems and offer our recommendations.

### FEATURES OF THE DWIGHT-LLOYD RESEARCH SINTERING MACHINE

- ★ Up draft, down draft or combination operation for maximum flexibility
- ★ Utilization of hot gases for full heat recuperation or gas enrichment
- ★ Upper and lower windboxes compartmentized to give any recirculation setup
- ★ Interchangeable pallet sides for research in bed depths
- ★ Rowen windbox seal eliminates air leakage between pallets and windbox, resulting in greater production of a more uniform product, at lower costs
- ★ Discharge curve virtually eliminates spillage of sintered fines into machine

**SINTERING MACHINERY CORPORATION • 155 Sinter Avenue, Netcong, N. J.**



# REDUCE FROTHER CONSUMPTION WITH DOWFROTH\* 250

Quality frothing agent by DOW  
works harder on the machine for low-cost  
flotation with improved metallurgy



The ability of Dowfroth to build higher quality froth more economically is now well established. Many mills can testify to this. For example, at one mill Dowfroth 250 produced improved metallurgy with consumption one-fourth that of the previous frother used! For added economy, Dowfroth's water solubility results in its measurable return to the flotation circuit in water recovery systems.

Dowfroth 250 is essentially free of collector properties, making it particularly effective for selective flotation. This superior frother is also easy to handle, can be stored in any climate, and is readily available.

Consider the economy and efficiency of Dowfroth 250 for your operation. Send for a *free sample*, from Dow, Dept. OC 3-35A. THE DOW CHEMICAL COMPANY, Midland, Michigan.

\*Trademark

*you can depend on* DOW CHEMICALS



MINING WORLD



cut  
corners  
from time  
schedules  
and cost  
estimates  
with...



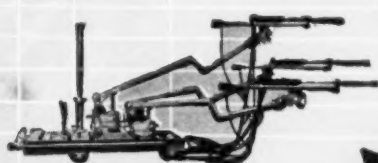
**DEEP HOLE DRILL**—The NEW SFH99—with Gardner-Denver Sectional Rods—permits a 4' change when ring drilling from a 7' drift.



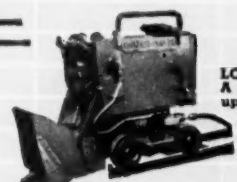
**DRIFTER**—A fast driller—with a long feed.



**STOPPER**—Balanced to boost production.



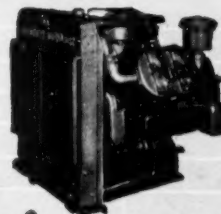
**JUMBO**—For a quick set up and get out.



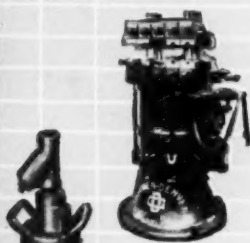
**LOADER**—A quick pick-up for profits.



**PORTABLE COMPRESSOR**—Moves air right in—anywhere.



**STATIONARY COMPRESSOR**—Cuts air costs at the source.



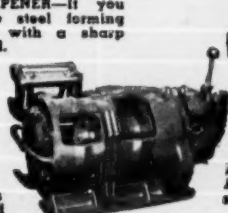
**SHARPENER**—If you figure steel forming costs with a sharp pencil.



**HOIST**—Gives a lift to productivity.



**SUMP PUMP**—Sucks nuisance water out of the way.



**LINE OILER**—Automatically saves wear on rock drills.



**AIRSLUSHER**—A steady tug cuts slushing costs.

## GARDNER-DENVER MINING EQUIPMENT

Send for descriptive Bulletins.

SINCE 1859

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Export Division: 233 Broadway, New York 1, N.Y., U.S.A.

Gardner-Denver Company, Quincy, Illinois, U.S.A.

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

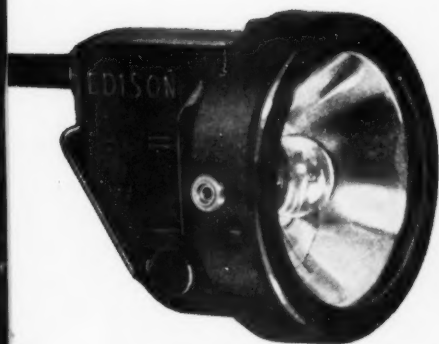


**WHEEL TRUEING  
TOOL COMPANY**

3200 W. Davison Avenue  
Detroit 6 • Michigan

**WHEEL TRUEING TOOL CO.  
of CANADA, LTD.**

575 Langlois Avenue  
Windsor, Ont. • Canada



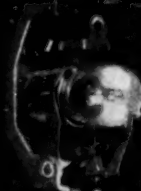
#### HEADPIECE HOUSING

Molded of tough, lightweight plastic. Designed to direct the light to the job.



#### DOUBLE FILAMENT BULB

Two filaments of equal light output in one bulb. If one filament burns out, second filament restores full light.



#### ADJUSTABLE CRADLE

Positive screw control moves bulb cradle for accurate spot-beam focusing.



#### BEZEL RING AND LOCKS

Sturdy bezel makes tight seal, is easily removed. Contains rubber-cushioned lens. Locks prevent tampering.



#### EXCLUSIVE NICKEL-IRON-ALKALINE CELLS



Battery does not destroy itself to function; does not deteriorate when not in use. Welded steel containers enclose the cells and the entire battery is encased in a high-strength, non-combustible, corrosion and impact resistant molded nylon case. The valve block is one-piece nylon construction, easily removed. All exterior metal parts are stainless steel. Rugged head contains dependable magnetic lock device.

# THE EDISON R-4

*... is worth looking into*

Convincing testimony that **QUALITY COUNTS** in underground illumination is provided by the world-wide acceptance of the Edison Electric Cap Lamp.

Designed from a thorough knowledge of overall mining problems, the Edison R-4, made up of compact, easily handled sub-assemblies, has the

**QUALITY** features that keep a brilliant, unfailing beam on the job, shift-after-shift, for years.

We'll be glad to show you how this **EDISON R-4 QUALITY** can put new peaks on your production records, safely.



When you have a safety problem, M.S.A. is at your service.  
Our job is to help you.

OCTOBER, 1953

#### MINE SAFETY APPLIANCES COMPANY

Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa.

At Your Service:

69 Branch Offices in the United States & Mexico

#### MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED

Toronto, Montreal, Calgary, Winnipeg,  
Vancouver, New Glasgow, N.S.

[World Mining Section—11]

11

# MARION

# 151-M

## SEVEN CUBIC YARDS



### This Big, Fast, Hard-Hitting Shovel Is Making History in Metal Mining

The seven-cubic-yard dipper of the MARION 151-M is only one indication of the work it can do.

The small-machine cycle time made possible by the world's finest electrical controls makes the 7-yard dipper of the MARION 151-M more productive than you might expect.

The month-after-month dependability of the 151-M, except for routine maintenance, is another

big factor in year-long production output.

Don't say "seven isn't enough" until you see what others are doing with the biggest seven-yard performer that ever hit the mine pits.

Some of the biggest companies in mining are 151-M owners. More than half of these owners have two or more 151-M machines. Your nearest MARION District office can show you why.

# MARION

**POWER SHOVEL CO.**  
MARION, OHIO, U. S. A.



from  $\frac{3}{4}$  cu. yd.  
to 45 cu. yds.

OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES

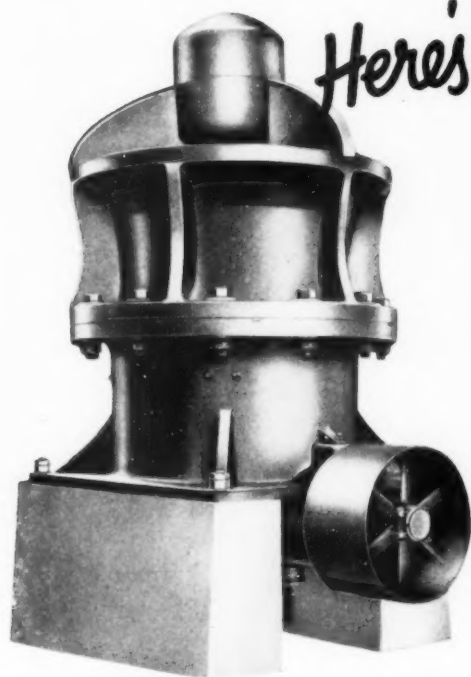
[World Mining Section—12]

MINING WORLD



# *You Get...* **PRODUCTION** **AT A PROFIT**

with  
**TRAYLOR  
TY**  
Reduction  
Crushers



*Here's why...*

More than 806 operators all over the world can vouch for superior operating efficiency of a Traylor TY. Over half a century of engineering skill is back of every Traylor TY Reduction Crusher. The result is a compact secondary crusher, simple in design, into which is built a maximum of strength. Highly efficient, Traylor TY Crushers require minimum floor space and little head room. Check the following features that combine high production, economy of operation and lower maintenance costs into *one* great crusher . . . the "Traylor-Made" TY.

- Cast steel frame, upper shell and spider of one piece
- Traylor original, non-chokable, self-tightening bell head and curved concaves, made of manganese steel
- Traylor patented dust seal, excludes dust and grit from the lubricating chamber
- Positive, automatic force-feed lubrication system, with water-cooled oil reservoir
- Machine-cut steel gearing
- Self-contained countershaft bearing, fitted with roller bearings and automatically lubricated
- All-around bottom discharge, without diaphragm

# **Traylor**

## **TY REDUCTION CRUSHER**

**TRAYLOR ENGINEERING & MANUFACTURING CO.**  
1573 MILL ST., ALLENTOWN, PA.

Send me your Bulletin 7112 on Traylor TY Reduction Crushers.

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Company: \_\_\_\_\_

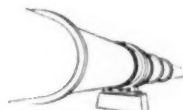
Address: \_\_\_\_\_

State: \_\_\_\_\_

Sales Offices: New York • Chicago • San Francisco  
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.



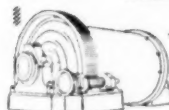
Primary Gyratory Crushers



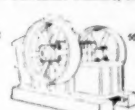
Rotary Kilns



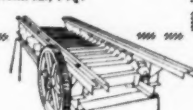
Secondary Gyratory Crushers



Ball Mills



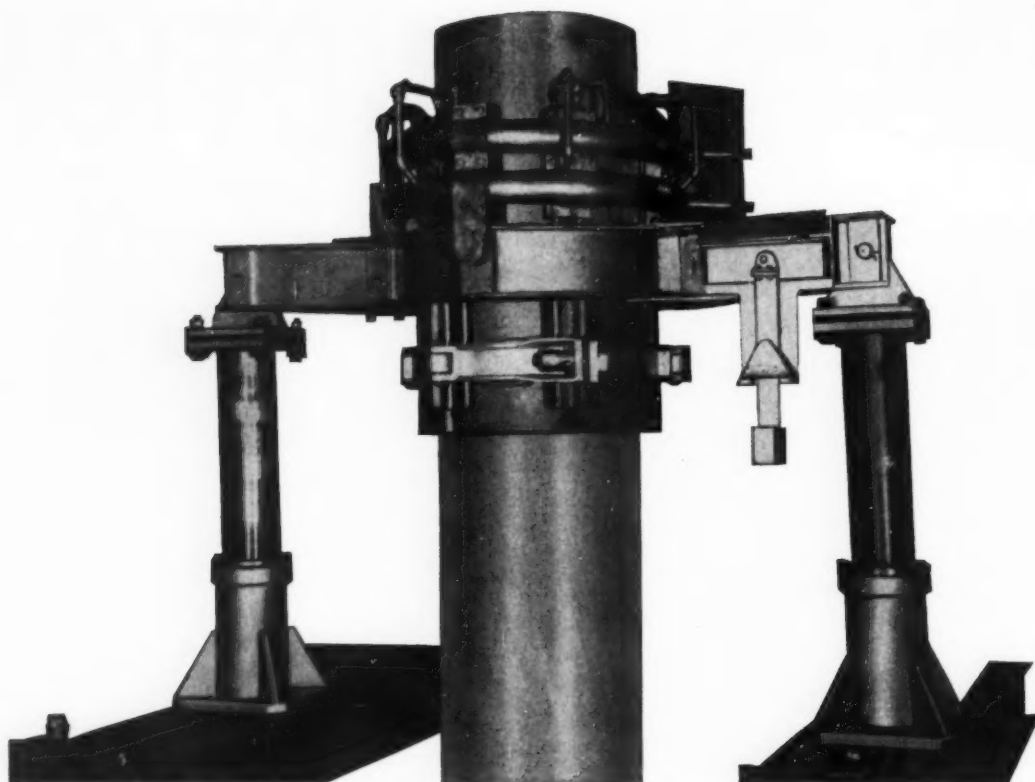
Jaw Crushers



Apron Feeders

OCTOBER, 1953

[World Mining Section—13]



when your smelting furnace  
must be **SPECIAL ...**

Lectromelt\* Furnace engineers produced this hydraulic electrode lift to provide unobstructed space over a smelting furnace. "We must have free headroom," was our customer's specification.

The lift is self-leveling as it raises and lowers the giant 30-inch electrode. The special clamp, also produced by Lectromelt engineers, grips the electrode firmly and safely without harming the carbon. The Lectromelt assembly gave

the customer exactly what he wanted.

You may have similar *special* furnace requirements. If so, you can be sure that Lectromelt Furnace engineers are qualified to design and produce the type of equipment you need.

Write for Bulletin #105 which describes Lectromelt Smelting and Reduction Furnaces in detail. Pittsburgh Lectromelt Furnace Corp., 324 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Bolge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

\*REG. U. S. PAT. OFF.

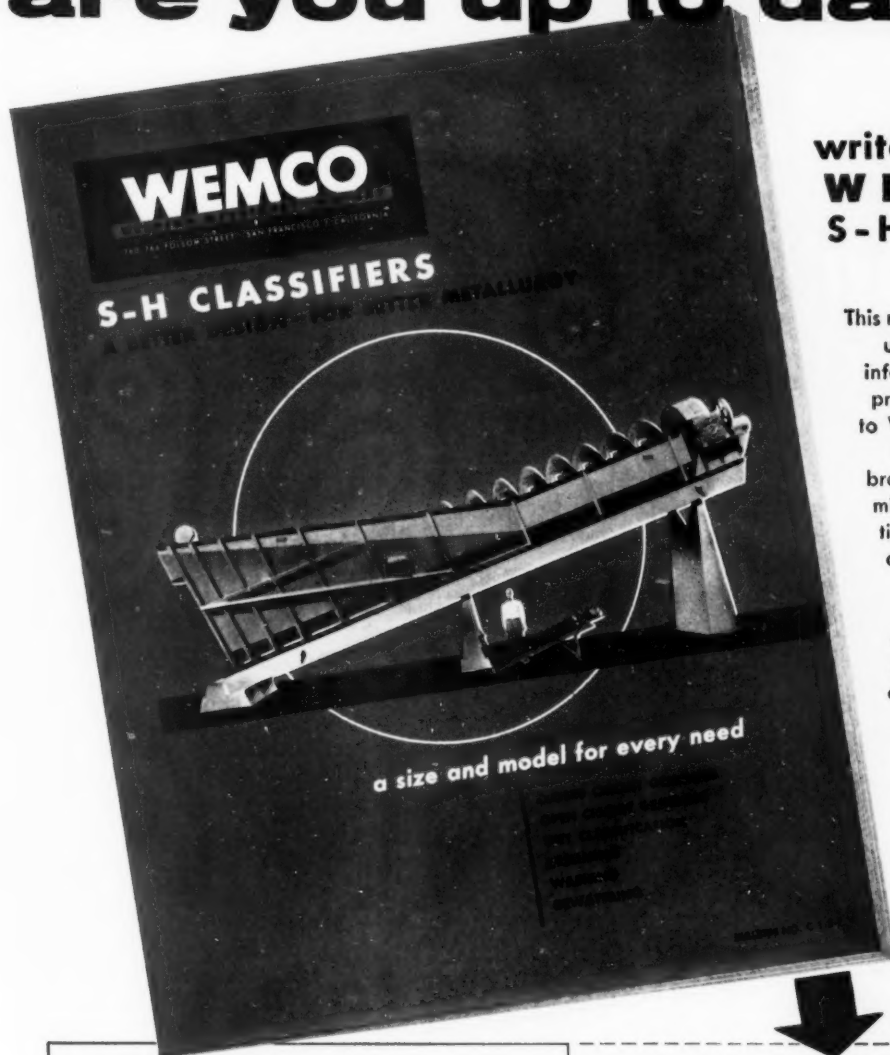
WHEN YOU MELT...

MOORE RAPID

*Lectromelt*



# are you up to date?



## write for the new **WEMCO** **S-H CLASSIFIER** **BULLETIN**

This new bulletin contains valuable, up to date mineral engineering information on wet classification principles and their application to Wemco S-H Classifier design.

Fully illustrated, this 20 page brochure is designed for use in mineral dressing, coal preparation, aggregate production and other related processing fields.

It provides a store of useful information for ready reference by mine managers, general and mill superintendents, metallurgical and process engineers, design engineers, millmen, students and others.

**SUBJECTS COVERED**—Here is a sample of some of the important subjects covered in this presentation:

- WET CLASSIFICATION PRINCIPLES
- DESIGN PRINCIPLES
- METALLURGICAL PRINCIPLES
- CAPACITY TABLES
- BALANCED PERFORMANCE
- FIELD APPLICATIONS
- DESIGN SPECIFICATIONS
- OPERATING CONTROLS
- DIMENSIONAL DRAWINGS
- PROPER CHOICE OF MODELS
- SHIPPING WEIGHTS AND VOLUMES
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Mobil Mills • Coal Spirals • HMS Thickeners • HMS Pumps • Sand Pumps • Agitators  
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**WRITE NOW**—just fill in coupon for your free copy of this valuable bulletin. If you would like extra copies for your associates, simply tell us how many. No obligation, of course.

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760 Folsom Street Dept. B  
San Francisco 7, California

Gentlemen: Please send \_\_\_\_\_ copies of the new Wemco S-H Classifier Bulletin.

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Company \_\_\_\_\_

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# are you using hardfacing effectively?

**BE SURE—READ AMSCO'S NEW  
CATALOG ON HARDFACING ALLOYS**

Whatever the application, whenever you are in doubt about what hardfacing alloy to use, you can reach for the new Amsco Catalog for the answer. It gives you complete analyses, metallurgical information, and other pertinent data about Amsco's line of automatic and manual hardfacing alloys. You can look up the right rod to use for hundreds of the more common applications. And for those extra tough jobs, you'll find the section on How to Select a Hardfacing Alloy indispensable. Although it's written by welding engineers, this new catalog is easy to understand and to apply its suggestions to your own operations.

*It's FREE—write to Amsco  
today for your copy*



## **AMERICAN MANGANESE STEEL DIVISION**

425 East 14th Street • Chicago Heights, Ill.

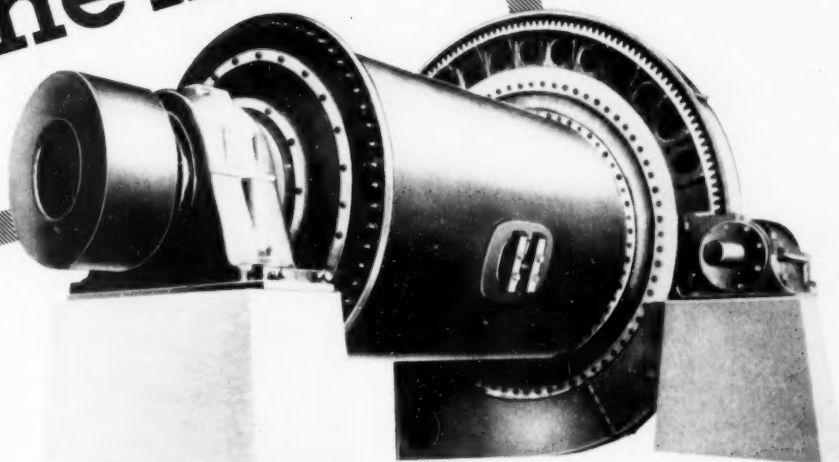
Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.



# GRINDING MILLS "Traylored" to the trade

... produce  
"Custom Made"  
products  
... and profits



**TRAYLOR GRINDING MILLS** are engineered to exacting specifications developed from two important sources . . . data furnished by you, the customer, and the knowledge of Traylor engineers gained from half-a-century of experience.

Traylor driving gears are steel . . . precision cut with high and low addendum on our MAAG gear generator. Precision workmanship, combined with pressure lubricated main bearings plus trunnions

cast integral with detachable heads result in more efficient, smooth working mills that reduce maintenance costs and cut down-time loss. All Traylor Grinding Mills are completely erected before being shipped to insure easy, trouble free installation on arrival.

The application of Traylor experience to your specific requirements makes a "Traylor-Made" mill the logical choice for you.

# Traylor GRINDING MILLS

**TRAYLOR ENGINEERING & MANUFACTURING CO.**  
1563 MILL ST., ALLENTOWN, PA.

Free Bulletin: Mail this coupon today for your copy of Traylor's Bulletin 6121 which gives full details on Traylor Grinding Mills.

Name: \_\_\_\_\_

Position: \_\_\_\_\_

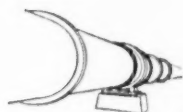
Company: \_\_\_\_\_

Address: \_\_\_\_\_ State: \_\_\_\_\_

Sales Offices: New York • Chicago • San Francisco  
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.



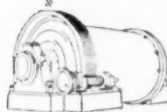
Primary Gyratory Crushers



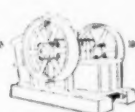
Rotary Kilns



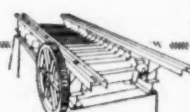
Secondary Gyratory Crushers



Ball Mills



Jaw Crushers



Apron Feeders

OCTOBER, 1953

[World Mining Section—17]

*Another Example  
of  
Efficient Power  
at Lower Cost*

This new Cooper-Bessemer-powered 200-W Bucyrus-Erie walking dragline, owned by Miami Crushed Stone Co., Miami, Fla., is shown digging unshot limerock from a 24-foot pit at the rate of 300 yards per hour. The engine is a dependable Cooper-Bessemer Type GS rated 385 bhp.



## **COOPER-BESSEMER DIESELS . . .** *. . . noted for "digging in" — without complaint!*

**F**OR example . . . President G. D. Monroe of the Miami Crushed Stone Company has this to say . . .

*"This machine is digging an oolitic formation, and it is doing a good job without the rock having to be drilled and shot. We are very much delighted with the performance of your engine, and the whole machine for that matter."*

If you have a power job coming up—mobile or stationary—Cooper-Bessemer can help you keep costs down, production up! They're designed and built that way. So get all the facts on these modern engines before going ahead with that next powering job of yours.



New York  
Seattle

Washington, D. C.  
Tulsa      Shreveport

Bradford, Pa.  
St. Louis

San Francisco  
Los Angeles

Chicago

Houston, Dallas, Greggton, Pampa and Odessa, Texas  
Gloucester, Mass.      New Orleans, La.



## A NEW ONE-MAN DRILLING MACHINE

*with integral air-leg feed and  
automatic air-water back-head*

Perfected  
by

**Thor**

### No. 380 AUTOMATIC DRILLING MACHINE

*With Aluminum Cylinder  
and Piston*

TOTAL WEIGHT 80 LBS.  
36" OR 48"  
FEED



INTEGRAL AIR FEED eliminates improvised clamping, extra air hose; consolidates drilling and feed controls on back-head of machine. Easier to set up, easier to adjust, easier to run.

AUTOMATIC AIR-WATER BACK-HEAD controls water and air from single throttle. Optional plugs for dry collaring, or dry drilling. Provides complete versatility for all drilling conditions.

### Check these **Thor** features!

- 1 CONTROLS conveniently grouped on back-head for safe, convenient operation.
- 2 EXCLUSIVE SIX POSITION THROTTLE VALVE . . . from complete shut-off of air and water, to full air and water in logical steps for full control and convenience.
- 3 AIR LEG CONTROL KNOB conveniently located for natural, right-hand operation. Exclusive instantaneous push-button release for safety.
- 4 SINGLE AIR HOSE supplies air to drill and to leg (through drill and mounting swivel).
- 5 PERFECT BALANCE of drill and leg eliminates superfluous adjustments.
- 6 HINGE JOINT between drill and leg has tension adjustment. Exclusive extra-large friction disc holds selected tension indefinitely.
- 7 CONSTANT BLOWING ACTION cleans holes of cuttings, keeps cuttings out of chuck and drill.
- 8 FOR USE AS SINKER, air leg can be easily detached by loosening one nut.
- 9 WATER AND AIR HOSE swing freely at left, out of operator's way. Exclusive fastening method eliminates possibility of connections loosening or leaking.
- 10 EXCLUSIVE 2 1/4" DIAMETER FEED LEG provides added pressure to keep bit on face for longer life, especially when tungsten carbide bits are used.
- 11 EXCLUSIVE NEW HOLDING HANDLE provides greater safety. Conventional spade handle optional.
- 12 EXCLUSIVE SCRAPER RING on piston rod prevents solids from entering cylinder. "O" ring seal repels liquids.

*For Complete Details or Demonstration Write*

**Thor** PORTABLE POWER  
**TOOLS**  
THOR POWER TOOL COMPANY  
Aurora, Illinois

Export Division, 330 W. 42nd St., New York 36, N. Y., U. S. A.

Central America: Herramientas Thor de Mexico, S. A. de C. V., Basilio Badillo No. 47 Mexico, D. F. Mexico

South America: Thor Tool Hemisphere, Inc., Visconde do Parahyba 1199, Caixa Postal 2899, Sao Paulo, Brazil

Western Europe: Thor Tool Continental, Inc., Nattenhuis Jordaenskaai 25, Antwerp, Belgium

**S-A**

**CONVEYING**  
*System* carries  
**MANGANESE ORE**  
 through processing  
 to storage

From the desert land of southern Nevada manganese oxide flows to the American steel industry—via S-A conveyors. The cost of working these domestic deposits is high. With this in mind, S-A engineers designed a conveying system low in initial cost—high in performance for the estimated life of the project.

With a background of over fifty years of experience in the mining industry, S-A engineers have become familiar with its particular problems. Every S-A designed system is both mechanically and economically right!

Depletion, price fluctuation and rugged operating conditions are just a few of the multiple considerations that precede an S-A job recommendation. You assume no obligation when you call on your nearest S-A representative for his "made to measure" solution to your conveyor problems.

Belt Conveyors	Conveyor Belt Cleaners
Belt, Pan & Plate Feeders	Headshaft Holdbacks
Ship Loading Boom Conveyors	Grizzlies & Screens
Stacking Conveyors	Centrifugal Pilers
Storage & Reclaiming Systems	Bin Gates & Tunnel Gates
"Natural Frequency" Vibrating Conveyors	Car Pullers & Spotters
REDLER Conveyor-Elevators	Bucket Elevators
ZIPPER Conveyor-Elevators	Skip Hoists
	SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above



▲ General view of storage conveyor. Stacking boom can be raised or lowered to suit height of storage pile and prevent degradation.

▶ S-A Pan Conveyor carries hot nodulized ore from calcining kiln to sampling station.

**MANGANESE INC.**  
 Henderson, Nevada

Rough ore travels by S-A Belt Conveyor to storage. It is reclaimed for processing and discharged from the concentrator plant as filter cake. A 24" belt conveyor carries the filter cake on a 256 foot slope run to the pug mills for blending. After discharge to kilns which nodulize the concentrate, the hot concentrate moves by pan conveyor to a sampling station. It is then fed to an 18" belt conveyor, 340 feet long. A traveling tripper with a 45-foot stacking boom piles it for storage.

**STEPHEN S-ADAMSON**

13 Ridgeway Avenue, Aurora, Illinois

MFG. CO.

Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT  
 [World Mining Section—20] MINING WORLD

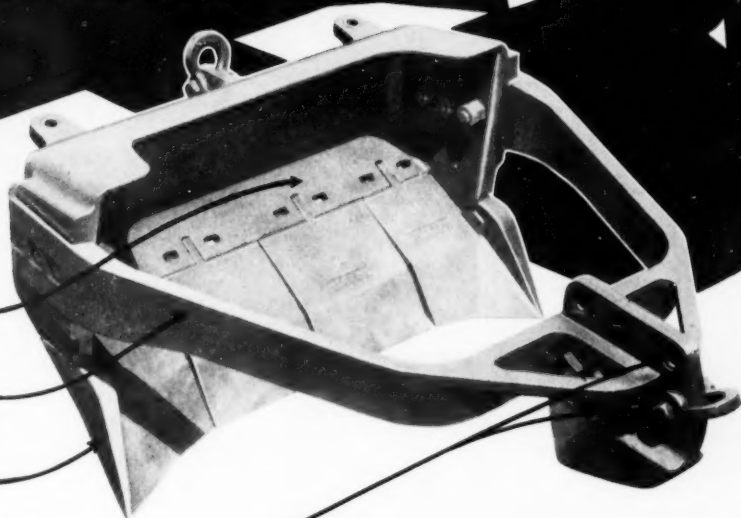


# Proved by Performance!

## *Pacific*

### SLUSHMASTER SCRAPERS

U.S.A. and Foreign Patents Applied For



#### LOW CENTER OF GRAVITY ★

Weight is concentrated over blades and side cutters.

#### HARNESS DESIGN ★

Acts as curved bumper to by-pass obstructions.

#### POSITIVE DIGGING ACTION ★

Blade and side cutter design of "Slush-master" is such that all models will immediately secure a load in a single pass, regardless of size or type of material or slope of muck pile.

#### ADJUSTABLE DIGGING ANGLE ★

Shackle may be changed to different locations on shoe. 2 or 3 holes are provided, depending on size of scraper.

#### EASY DISASSEMBLY ★

Can be taken down into four parts. Easy to move into any working place.

#### USERS SAY:

"You have to see 'em work to believe it,"...

"It's the 'slushingest' bucket I've ever seen,"...

"Best breast cleaning scraper ever designed,"...

"First scraper I ever saw that is a REAL scraper."

#### OUTSTANDING FEATURES:

Streamlined design. Rugged construction throughout. Simplified method of attaching blades and side cutters... change them in 15 minutes underground. Special Alloy Steel blades and side cutters designed for maximum toughness and wear resistance. Complete line - nine different models from 26" to 60" widths - 398 lbs. to 2275 lbs. Send for Bulletin No. 215.

#### ALLOY STEEL & METALS CO.

1848 EAST 55TH STREET, LOS ANGELES 58, CALIFORNIA

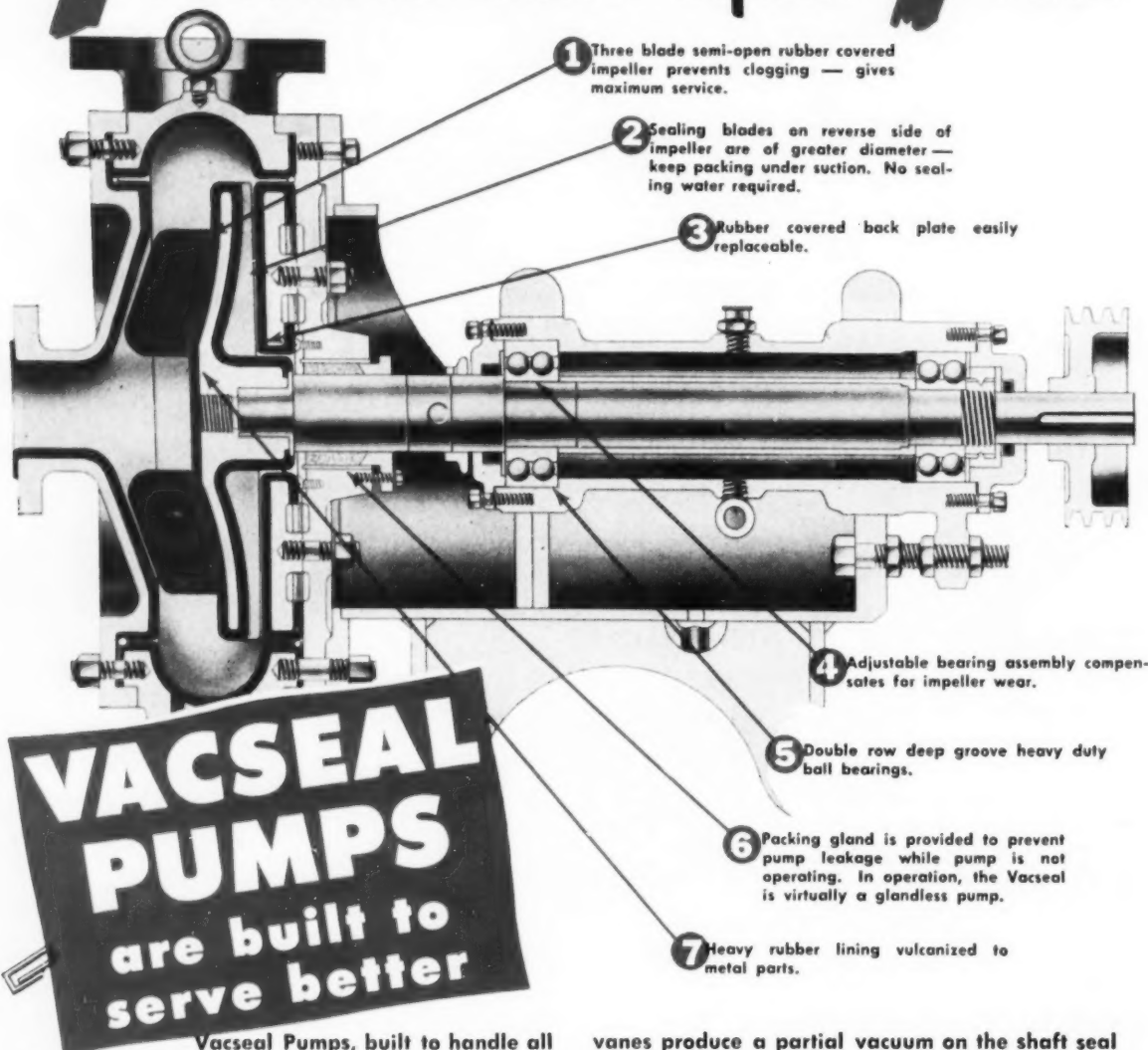
Mailing address: Box 15323 Vernon Station, Los Angeles 58, California

#### BE SPECIFIC—ORDER PACIFIC

For added efficiency, use Pacific Sheave Blocks, Sheave Anchors, "Round-The-Corner" Sheave Blocks, Jaw Crushers, Bit Knockers and Pacific Wearing Parts.

**ALLOY  
STEEL &  
METALS  
CO.**

# 7 features that equal 1 fact



Vacseal Pumps, built to handle all types of abrasive and corrosive pulps, embody the patented Vacseal design which prevents solids from entering the gland. The impeller of the pump is a disc with pumping vanes on one side and small auxiliary vanes of a greater diameter on the reverse side, next to the gland. The auxiliary

vanes produce a partial vacuum on the shaft seal and prevent solids from cutting the shaft or packing. This results in a virtually glandless pump that requires no sealing water. Solids and acid handling Vacseal Pumps in sizes 2" through 8". Capacity ranges from 50 through 3000 gpm. Models to handle heads up to 150 feet and suction lifts up to 12 feet. WRITE FOR BULLETIN PB-52.

**Leaders in Experience & Service**

**HOME OFFICE**  
545 West 8th South  
Salt Lake City, Utah  
P. O. Box 209

**EASTERN OFFICE**  
921 Bergen Avenue  
Jersey City, New Jersey  
Agents In All Principal  
Foreign Mining Districts

## THE GALIGHER co.

**CONSULTATION • ORE TESTING  
PLANT DESIGN • GEOLOGIC INVESTIGATION**

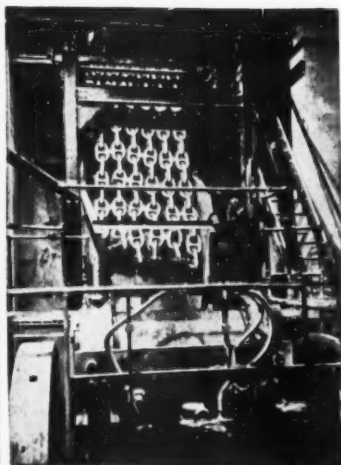


# ROSS FEEDERS

FOR HANDLING ORES, ROCK ETC.



ROSS CHAIN FEEDERS can be totally enclosed  
as at Sydvaranger.



TYPE OF  
ROSS CHAIN  
FEEDER  
USED AT  
SYDVARANGER



INSPECTION  
HATCH IN  
FRONT OF  
ORE CHUTE  
AT  
SYDVARANGER



Sydvaranger's problem is common to many operators. For purposes of dust control, they wanted to install coarse-ore feeders that they could enclose in a dust-tight housing. That meant they would have a big job every time they replaced a feeder or a feeder part.

So they chose three 60-inch Ross Feeders. One handles ore just after it passes through the primary crusher at Bjornevatn. Two others feed crushed ore to two cone crushers at Kirkenes.

If your problem is dust control, or if you're looking for a feeder that almost never gives trouble, install a Ross.

## ROSS SCREEN & FEEDER CO.

19 Rector Street  
New York 6, N. Y., U. S. A.

## ROSS ENGINEERS, LTD.

11 Walpole Road  
Surbiton, Surrey, England

CANADIAN LICENSEE: E. LONG LTD., ORILLIA, ONTARIO

# A/S Sydvaranger



250 miles north of the Arctic Circle, at Kirkenes, the Norwegian firm of A/S Sydvaranger has been mining and exporting taconite concentrates since 1910. Many of the techniques they have developed will be used on the Mesabi Iron Range of Minnesota where large-scale taconite mining is just being started.



For loading, Sydvaranger teams Tournarockers with  $4\frac{1}{2}$ -yard shovels. This size shovel was chosen because any ore that will pass through the dipper will enter the opening of the 56-inch primary crusher. Tournarockers were chosen primarily because their large, easy-loading body and all-steel bowl would best withstand heavy shock loads. At start of post-war operation, Sydvaranger bought 6 of these Rear-Dumps. They performed so well, the company since has added 6 more. Units work year-around — in the 30° below-zero cold which grips Kirkenes much of the Arctic winter, in the 90° heat of the short summer, in rain, and in snow.

- hauls taconite with  
12 Tournarockers

- cleans pits with  
2 Tournatractors

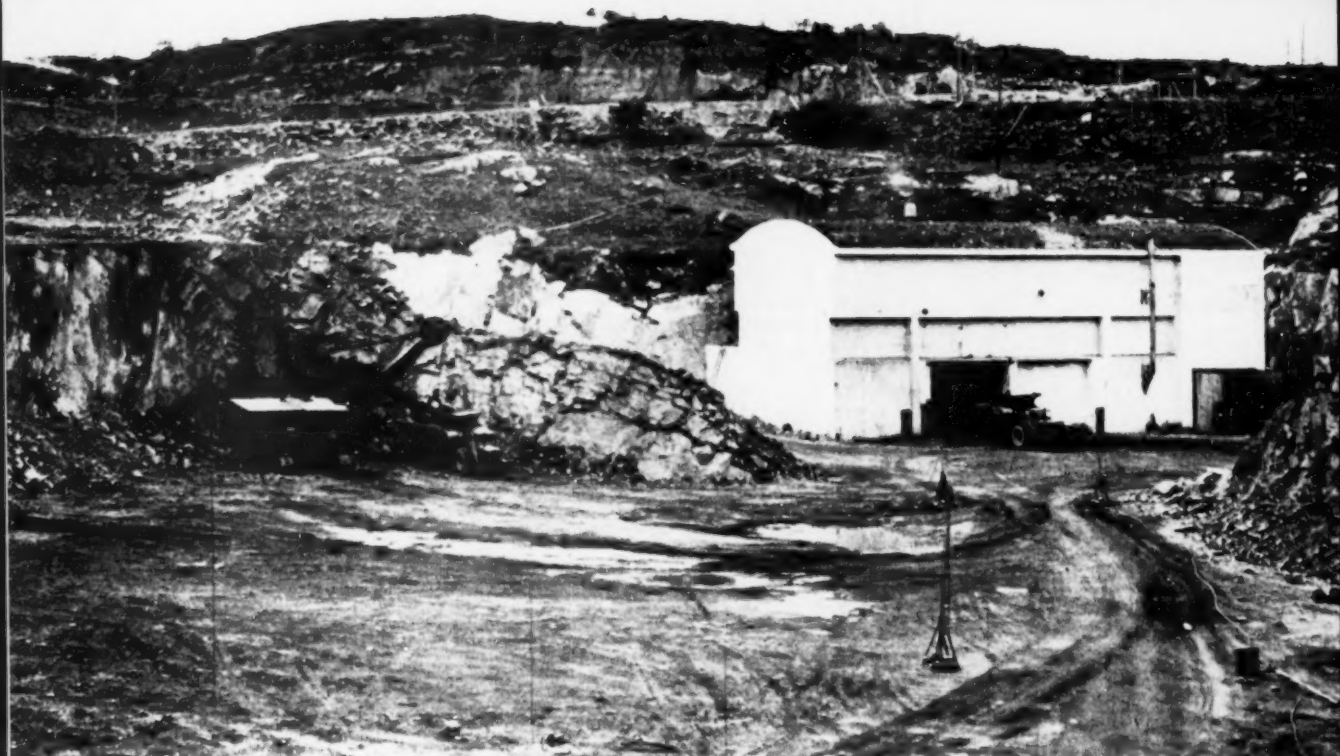


It takes only a few seconds for Tournarockers to dump 35 tons of taconite into the 56-inch primary gyratory crusher. This huge oil-cooled unit, which weighs about 600 tons, crushes the ore to minus 5 inches and discharges it into a 100-ton hopper. From the hopper, the ore is conveyed to a 10,000-ton storage silo, loaded through air-operated gates into 40-ton bottom-dump railroad cars, and hauled 6 miles to the mill. About 200,000 tons of ore are processed monthly. Plans call for Tournarockers to help remove 45,000,000 tons of ore and 20,000,000 tons of waste rock before open-pit operation gives way to underground mining.



**For more information on these units, see  
your LeTourneau-Westinghouse Distributor**





To maintain a heavy production schedule of 6,000 to 7,000 tons of taconite per 24-hour day, A/S Sydvaranger has assigned a large share of hauling to 12 Tournarockers. These giant Rear-Dumps carry 35 tons of blasted taconite ore per load. Here, two of them keep one shovel busy as they haul a short distance from

pit to crusher building. These LeTourneau-Westinghouse machines have been in steady use since the mine was re-opened after the war. They replaced haul units destroyed in air raids and by the scorched-earth policy of the Nazis as they retreated from the Russians. This photo and others courtesy of Mining World magazine.



With their multiple pit set-up, Sydvaranger needs dozers which can move fast from job to job. They fill this need by working 2 Tournatractors 24 hours a day. These rubber-tired units clean up around all 4 of the shovels now in use. They travel between scattered assignments at speeds up to 19 mph. They cross railroad tracks, pavement without damage. They even have spare time to build and maintain haul roads, clear land, and do general "house-keeping" chores. Sydvaranger officials are pleased with the speed, mobility and high production of Tournatractors, and say they out-perform crawler-tractors on every cleanup-type task.

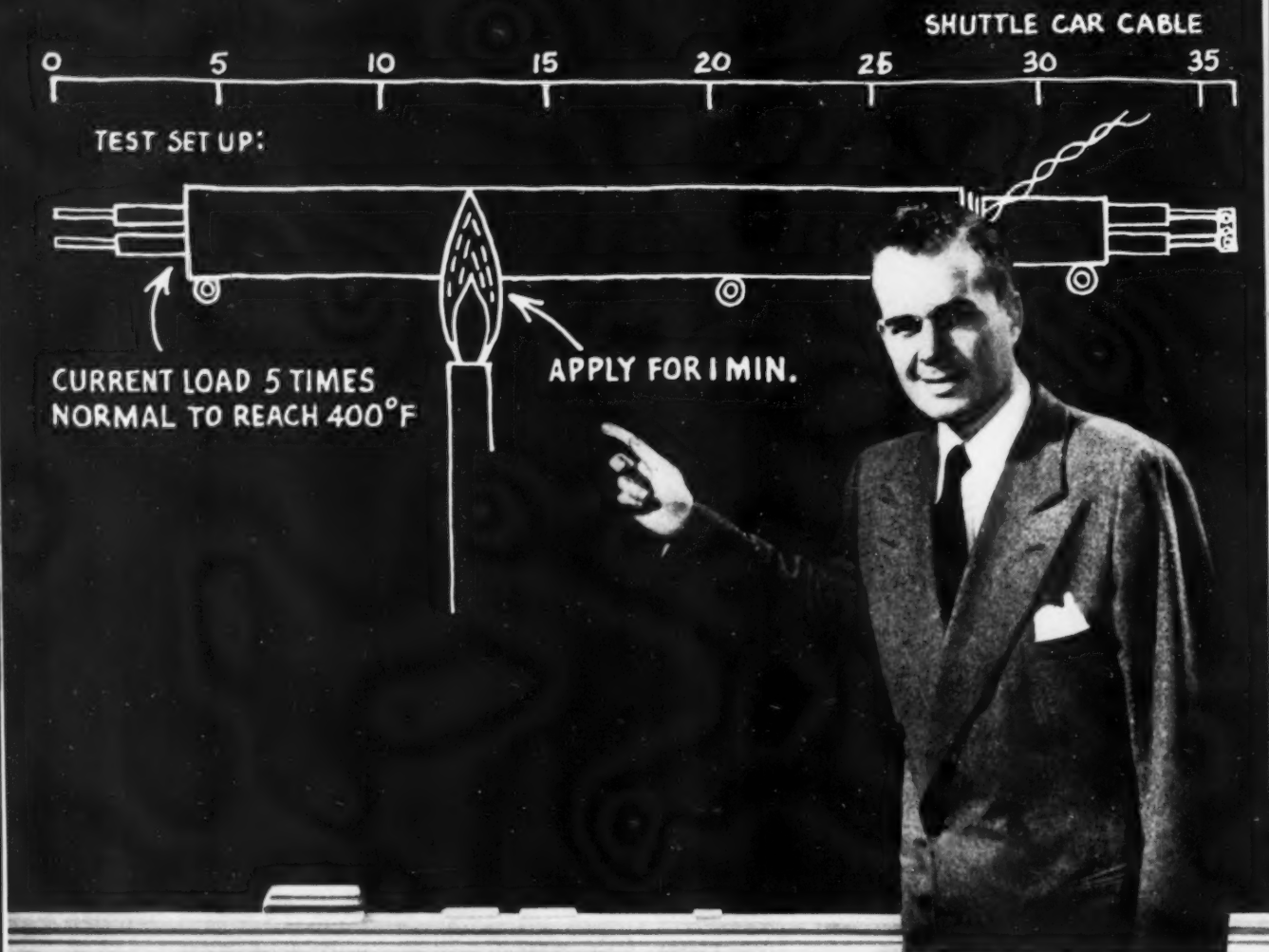


Despite the very abrasive footing common to taconite mines, tires of both Tournatractors and Tournarockers have averaged 6,000 to 7,000 working hours each. Original tread on Tournarocker drive tires lasts about 4,000 hours. Recapping adds the other several thousand hours of use. The life of these big single tires is far longer than that of smaller dual tires. Six feet in diameter and 2 feet wide, the single tires have no divided face for rock fragments to wedge in, wear and tear. They roll easily over rocks that bruise the lighter duals. They contribute substantially to the high efficiency of the entire mine operation.

Tournarocker—Trademark Reg. U.S. Pat. Off. Tournatractor—Trademark TAR-523-M

# LeTourneau-Westinghouse Company

PEORIA, ILLINOIS



**APPROVED USBM TEST:** Cable fails if it burns more than 6 inches or flames more than 3 minutes.

## NO ANACONDA CABLE EVER FAILED THIS TEST

The U.S. Bureau of Mines flame-test for trailing cables is tough. But ANACONDA Cables have passed every time...*with ease*. That's not all! Performance-wise, a recent survey of shuttle cars in 15 mines found ANACONDA Cables last up to 300% longer than cables used only a few years ago.

### NEW FEATURES GIVE CABLE STAMINA

These facts are as good a certificate of quality as any we know. As new features have been added to ANACONDA Shuttle Car Cables, each has been repeatedly tested on special, scientifically designed equipment. A new improved

neoprene jacket is tougher, more flame-resistant. You'll find more strength and heat-resistance in the new cold-rubber insulation. The cable has also been stranded in a new and decidedly better way. No wonder it can take more abuse from overloads, compression-cutting, sliver-cuts in wet mines, rib-pinching, runovers and dragging. Patented breaker strip\* and balanced tensile strength of ground and power conductors make it safer to use.

### A CLOSE LOOK AT CABLE COSTS

Examine this cable yourself. Ask your Anaconda Sales Office or Distributor

for a sample. Test it . . . tear it apart. Then look at the cost of *one* shutdown on any working face of your mine caused by *one* break in cheap cable. It far exceeds any possible saving from buying cable on price. Your own production figures soon prove the value of quality cable. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.*

\*U. S. Patent No. 2,455,773 3/29/51

## ANACONDA<sup>®</sup>

TODAY'S HEADQUARTERS FOR MINE CABLE

FLAT TWIN CABLES FOR  
shuttle cars  
continuous miners  
loaders cutters  
drill trucks



HI-VOLT CABLES FOR  
mine power



TYPE SH-D FOR  
shovels



TYPE SO FOR:  
hand drills  
remote control



TROLLEY WIRE



FEEDER CABLES



TELEPHONE WIRE



SHOT FIRE CORD



WELDING CABLES

# Setting the Pace For TACONITE PROCESSING

## LOW-HEAD Screens

ALMOST EVERY SINK FLOAT plant on the iron range uses *Low-Head* vibrating screens. Operators depend on these Allis-Chalmers screens for high media recovery, low maintenance, years of profitable service.

And now, as the taconite program develops, the proven performance of *Low-Head* screens is of increasing importance in the processing of low grade iron ore.

In the processing of other ores, too, mining men look to Allis-Chalmers for vibrating screens, scalping screens, jaw and gyratory crushers, grinding mills.

Allis-Chalmers builds a broad range of equipment for mining, backed by unsurpassed experience and engineering. It will pay you to call the Allis-Chalmers representative in your area, or write Allis-Chalmers, Milwaukee 1, Wisconsin, concerning your problems.

A-4073

Low-Head is an Allis-Chalmers trademark.

# ALLIS-CHALMERS



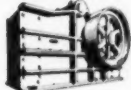
Sales Offices in  
Principal Cities in  
the U. S. A. Distributors  
Throughout the World.



Hammermills



Vibrating Screens



Jaw Crushers



Gyratory Crushers



Grinding Mills



Kilns, Coolers, Dryers

OCTOBER, 1953

[World Mining Section—27]

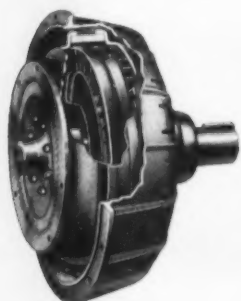
27



## How Hydraulic Coupling Works in a Power Shovel

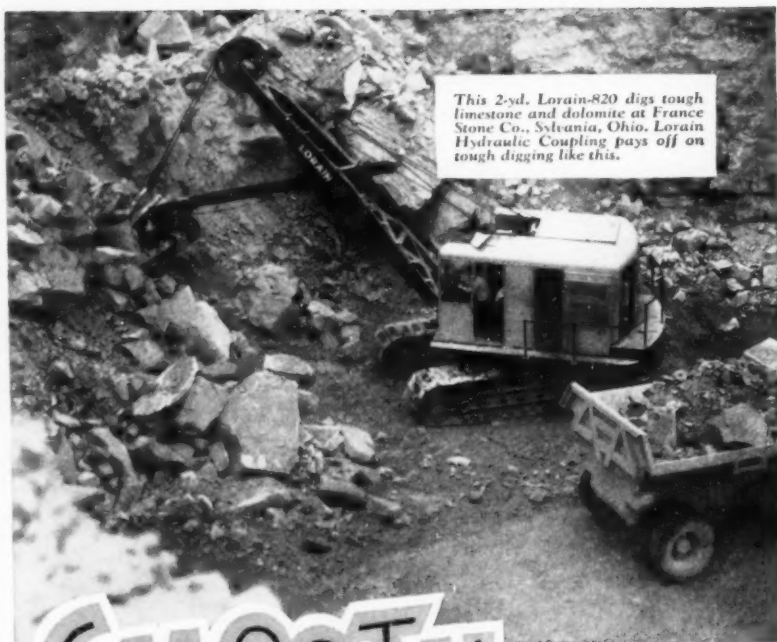
The hydraulic coupling type of power take-off has been proven over the years to add greatly to shovel-crane performance and life. It absorbs the impacts and shocks of hard digging, thereby reducing strain and wear on cables, machinery and engine, and it prevents the engine from stalling under any digging or lifting conditions—which is a time-saving, machine-saving feature. These many advantages are readily acknowledged by most shovel-crane men, but even some of those who like what a hydraulic coupling does for them, find it difficult to understand just how it works.

It is a load limit clutch that efficiently transmits full engine power under normal



conditions but "slips" when a shovel dipper, for example, is "hung up" on an immovable rock. This allows the engine to continue to develop full torque, with no abnormal strain on it, the machinery or cables. There is no shuddering to a standstill with stalled engine and the immeasurable strain this puts on the whole machine, as encountered with a friction type of take-off.

Even with a mechanical, band type of slip clutch, which is meant to provide shock relief, a maximum point of shock must be reached first before it becomes operative and is released. On the other hand, the hydraulic coupling has an infinite number of points of release, so to speak, which come into operation before the point of shock or overload is reached and not after. There is no surface friction, no mechanical wear, no overheating of parts. While it is mounted directly on the engine drive shaft, its "cushioning" effect would be as great no matter where it was located in the power train. It absorbs shock in both directions from itself thus giving protection from the dipper teeth to the engine. However, placed where it is, it acts on all phases of operation—hoist, swing, travel, crowd and retract.



This 2-yd. Lorain-820 digs tough limestone and dolomite at France Stone Co., Sylvania, Ohio. Lorain Hydraulic Coupling pays off on tough digging like this.

# SMOOTH

is the word  
when it's a **LORAIN-820** in rock!

Your eyes and ears can tell you what a beating your shovel takes in rock. It's a tough life — full of sudden shocks and impacts — that only the best design can withstand.

You will see a big difference in Lorain-820 shovel performance . . . the difference made by the use of Lorain's Hydraulic Coupling. This efficient fluid drive *smooths* out the shocks and impacts, *cushions* them before they have a chance to wrack and strain turntable mechanism and cables. Lorain's steady power keeps "hanging on" until the most unyielding rock is in the dipper — the toughest digging cannot stall the engine. Available air controls and air assist of crowd and travel operations make the operator's job smooth and easy. The net result — more rock in the trucks at the end of the day!

See a Lorain-820 in action. Ask your Thew-Lorain Distributor to show you the "smoothest" rock shovel you can buy.

SEE THE **THEW LORAIN 820** ASK YOUR DISTRIBUTOR

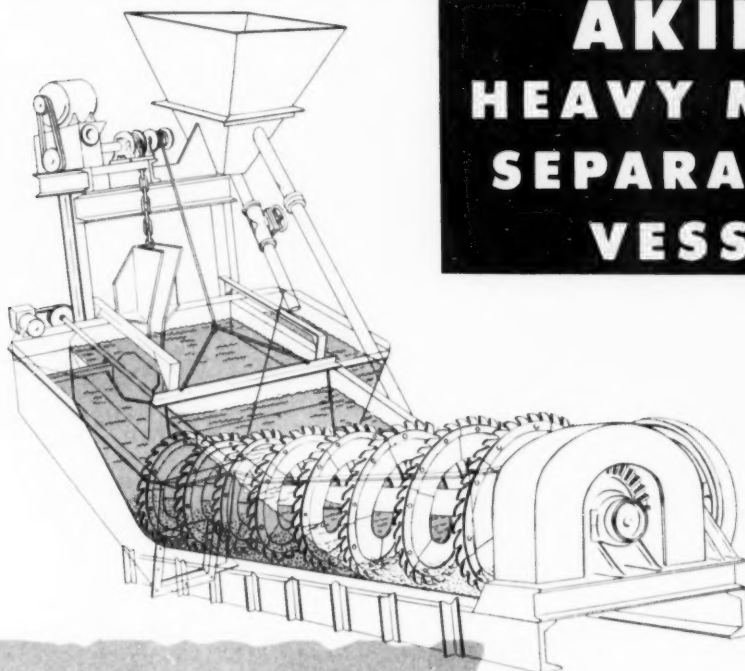
# THEW LORAIN®

SHOVELS • CRANES • CLAMSHELLS • DRAGLINES • HOES



## PROVED ADVANTAGES of

# AKINS HEAVY MEDIA SEPARATORY VESSEL



### ENTIRE VESSEL IS VISIBLE

The Akins vessel is fully open for visual inspection and all wearing parts are easily accessible. It is a simple matter to sample any portion of the separatory pool or any of the products to check density or degree of separation. Due to the open construction, any slight modification that might be required to improve separation can be easily made. The tank is bedded with solids so it does not wear.

### OTHER OUTSTANDING ADVANTAGES OF AKINS

Large pool area and volume facilitate better recovery of values from fine sizes.

Variation in feed rate or grade of feed is not detrimental.

No intermixing of sink and float in product discharge.

Circulation of media at lower gravity and viscosity.

Gradation of gravity and viscosity from feed entry point to sink removal point provides natural cleansing of sink.

Three product separation in one machine.

*Akins—the ORIGINAL spiral type classifier.*

## COLORADO IRON WORKS CO.

1624 17th Street • Denver 2, Colorado

AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

*Sales Agents and Licensed Manufacturers in Foreign Countries*

A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.



OCTOBER, 1953

[World Mining Section—29]

29



## Six Merrick Weightometers\* Give a Complete Tonnage-Performance Record

In the new field of taconite concentration, metallurgists need a complete and accurate record of tonnage in process. Managers and accountants need a highly accurate record of tonnage for shipment and sale.

At Sydvaranger, six Merrick Weightometers supply these records. This is how they do the job:

- **Mill Head Record** comes from a 42-inch Weightometer, with Rateograph\*. It strides the conveyor carrying minus-5-inch ore at the Bjornevatn crushing plant.
- **Ball Mill Performance** gets a close check from two 24-inch Weightometers, each

with Rateograph, on each of the two ball-mill circuits.

- **Dryer Performance** gets a similar check from two 24-inch Weightometers.
- **Shipment and Sale Records** come from a 42-inch Weightometer on the belt which conveys ore to the waiting ship in Varanger Fjord.



That's it: A complete, continuing, accurate record of tonnage everywhere it is needed. A Merrick record!

TEN WEIGHTOMETERS in all will be employed at this Plant. Two on their New Pelletizing operation and one on their Coal Belt

Write For Details

\* Reg. U.S. Pat. Off.

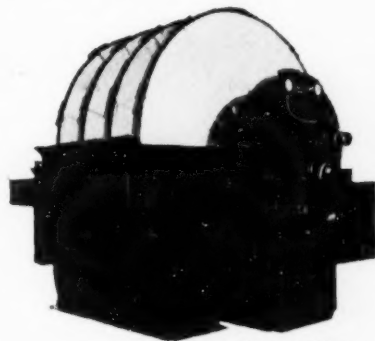
**MERRICK SCALE MFG. CO.**  
PASSAIC NEW JERSEY

## *The Eimco Agidisc Filter for Continuous Vacuum Filtration of Metallurgical Slurries*

These photographs show some of the important exclusive features offered in the Eimco Agidisc. Smooth, even, uniform cake formation in the two upper pictures which contrast with the typical standard disc filter with the heavy, lumpy build up of cake in the outside ring of the disc. (shown lower left.) The Agidisc with its uniformity of cake deposit, will make possible in your filtering station, higher capacity, lower moisture and longer bag life.

Our pilot plant will gladly run tests on your material and recommend size and type of filter to give you the best results. Write for information.



An Eimco Agidisc

# **EIMCO**

**THE EIMCO CORPORATION**

*The World's Leading Manufacturer of Vacuum Filtration Equipment*  
EXECUTIVE OFFICES AND FACTORIES - SALT LAKE CITY 10, UTAH, U. S. A.

**BRANCH SALES AND SERVICE OFFICES:**

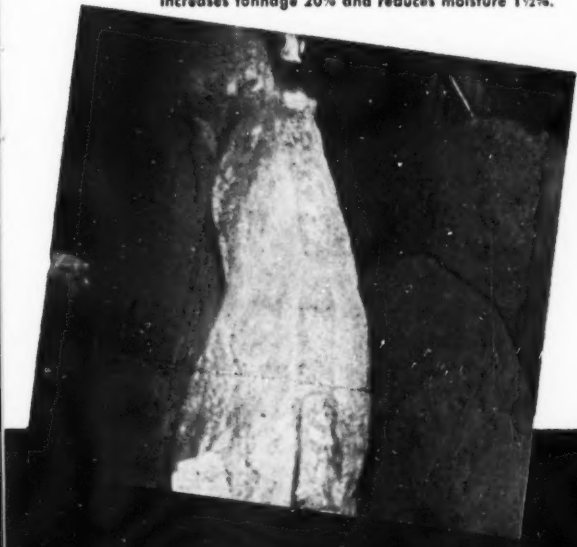
NEW YORK, 51-52 SOUTH STREET + CHICAGO, 3319 SOUTH WALLACE STREET  
BIRMINGHAM, ALA. 3140 FAYETTE AVE + DULUTH, MINN. 216 E. SUPERIOR ST.  
EL PASO, TEXAS - MILLY BUILDING + BERKELEY, CALIF. 637 CEDAR STREET  
KELLOGG, IDAHO 307 DIVISION ST. + LONDON W. 1 ENGLAND, 190 PICCADILLY

IN FRANCE SOCIETE EIMCO, PARIS, FRANCE

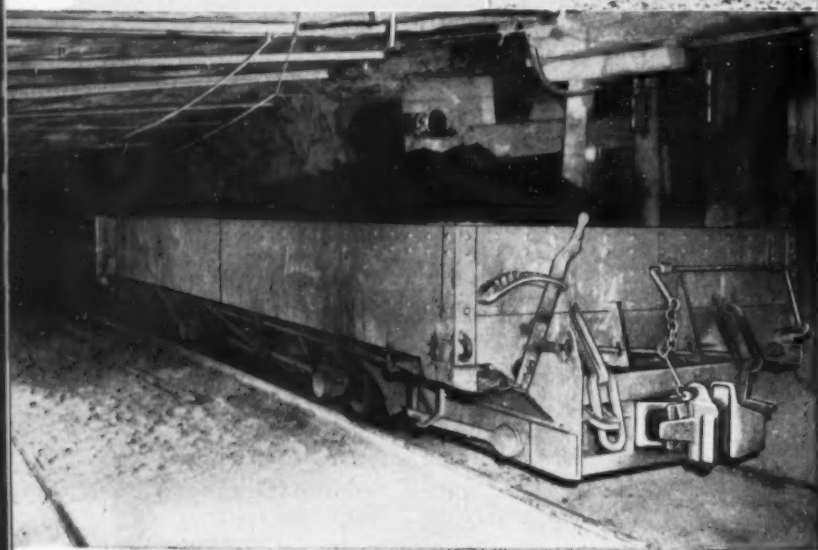
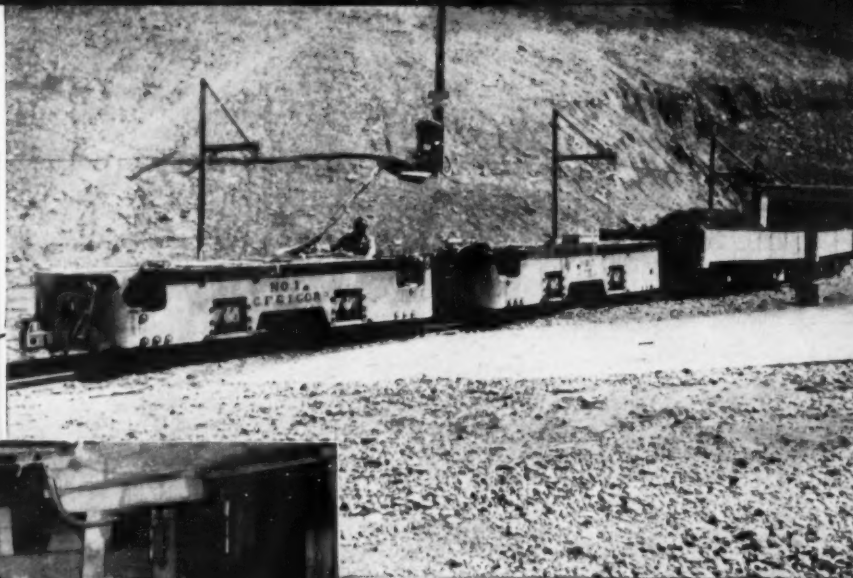
IN ENGLAND, EIMCO, GREAT BRITAIN LTD. LEEDS 12, ENGLAND

IN ITALY EIMCO ITALIA S.P.A. MILAN, ITALY

Above: Agidisc filtering copper concentrate. Below: Standard disc on same feed as filter above. Agidisc increases tonnage 20% and reduces moisture 1½%.



**From  
BEGINNING**



**to  
END**

## **CF & I's Allen Mine goes 100% WILLISON AUTOMATIC COUPLERS AND NATIONAL RUBBER-CUSHIONED DRAFT GEARS**

COLORADO FUEL & IRON COMPANY specified Willison Automatic Couplers and National Rubber-Cushioned Draft Gears *throughout* for the complete fleet of Goodman locomotives, Allison drop-bottom cars, and Differential man-trip cars at its new Allen Mine, newest and largest coal operation in the Far West.

### **Increased Output per day . . . Greater Safety for personnel**

Willison Automatic Couplers eliminate need to go between cars to couple or uncouple . . . give faster shunting and gathering . . . less spillage . . . no uncoupling during dumping operations. And National Rubber-Cushioned Draft Gears permit greater operating speeds . . . reduce wear and tear on rolling stock and trackage . . . cut spillage substantially.

So follow the lead of the leaders—specify Willison Automatic Couplers and National Rubber-Cushioned Draft Gears for all your new or rebuilt cars and locomotives. Literature available on request.

A-7919

**NATIONAL MALLEABLE and STEEL CASTINGS COMPANY**

Cleveland 6, Ohio

WILLISON AUTOMATIC COUPLERS • RUBBER & FRICTION DRAFT GEARS • NC-1 CAR TRUCKS  
NAGO STEEL WHEELS • NAGO STEEL LINKS & SWIVEL HITCHINGS





**Lead-Zinc Mining in Utah**—Bethlehem Hollow teams up with carbide-tipped bits on the 1500-ft level of the Mayflower Mine of New Park Mining Co. This jumbo-mounted drifter puts in 6-ft holes through abrasive sulphide ore bodies.



**Dam Building in Northwest**—Excavating work at the site of Chief Joseph Dam on the Columbia River called for more than 100 tons of Bethlehem Hollow. This is a recent addition to the long list of big projects where this "old reliable" of drill steels has had the responsibility for keeping drilling on schedule.



**Buffalo Underpass Job**  
—Rock drilling doesn't stop for chilly weather in Buffalo. Here Bethlehem Hollow bores into hard, flint-streaked rock on an excavating job that removed 70,000 cu yd of rock on a 4-lane underpass contract.

## Steel that chews rock from Vermont to California

Deep-holes, short-holes. Hard, abrasive ore . . . basalt . . . dolomite. Steel bits . . . bits with carbide inserts.

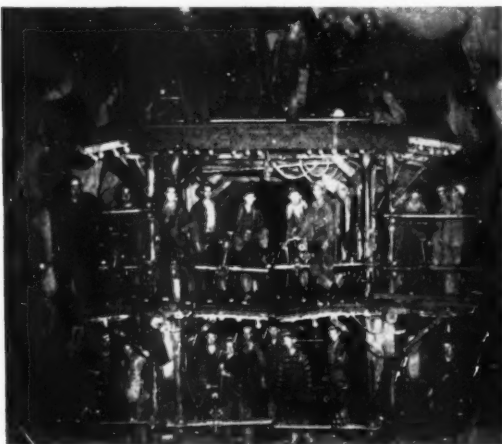
Whatever the depth of hole, type of rock, or style of detachable bit, there's one hollow drill steel that does the job from coast to coast, and does it well. It's Bethlehem Hollow.

Make sure you've got this old reliable on the job!

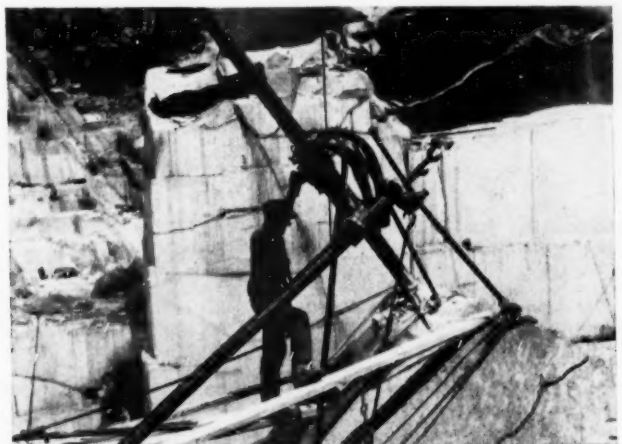
And if you need solid drill steel, quarrying steels, auger drill steel, or steel for stone-dressing tools . . . remember to specify Bethlehem. Each steel is engineered to give a lot of service.

**BETHLEHEM PACIFIC COAST STEEL CORPORATION**

*Sales Offices:* San Francisco, Los Angeles, Portland, Seattle, Spokane, Honolulu



**California Tunnel Project**—Here's the three-story drill carriage and one of the crews that smashed three records for driving large-diameter tunnels. Big Creek Project No. 4 was the scene of this outstanding performance of Bethlehem Hollow.



**Quarrying Vermont Granite**—A real test of drill-steel quality is provided by "Rock of Ages," a hard, dense-grained granite. This rock drill, using Bethlehem Hollow, is mounted on a movable saddle so that a line of holes can be drilled in perfect alignment. Quarries everywhere rely on Bethlehem Hollow.

# BETHLEHEM PACIFIC





## Important facts about pH for MINING & MILL OPERATORS

**W**HETHER you are building a new plant or modernizing present equipment, one of the most important advancements you can make is the installation of **BECKMAN pH CONTROL**. Throughout the mining industry—in gold, tin, tungsten, lead, zinc, copper and many other flotation operations—Beckman pH Control is proving to be the key to much higher recoveries, better control of processes, lower labor and chemical costs. Result—substantially greater profits per ton of ore. Some of the many benefits resulting from Beckman pH Control include . . .

- greater speed, convenience and accuracy in laboratory leaching or flotation tests.
- opportunity for centralized or automatic, control of multiple flotation circuits.
- reduction of corrosion and scaling in pipe lines.
- improved or automatic, control of electrolytic operations.
- and many other vital savings in mining and mill operations—savings that will quickly pay for the installation, and will continue producing extra profits year after year!

TO MAKE CERTAIN you get the latest, most convenient and most accurate pH equipment, be sure to specify "BECKMAN" . . .



Beckman pH equipment is completely electrometric, eliminating the mess and inaccuracies of colorimetric methods. Simply press a button and the exact pH of any process is instantly shown on a large easily-read dial. *It is the simplest of all pH methods!*



With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and *continuously*, if desired—on the process fluids themselves.



The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*



Unique rugged-type Beckman Electrodes, especially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

The above are only a few of many Beckman advantages. Write for the complete story.

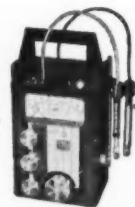
*There's a Beckman pH Instrument to meet your needs!*



**COMPLETELY AUTOMATIC!** The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*



**PORTABLE A.C. OPERATION!** The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v A.C. current. Compact, convenient and extremely simple to operate, the Model H gives instant pH readings on an easily-read dial. Widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.



**COMPLETELY SELF-CONTAINED!** The Beckman Model N is the ideal instrument where complete portability is desired. Operating from its own self-contained, long-life power supply, the Model N can be used anywhere—in plant, field or laboratory—without dependence on A.C. power circuits. Features maximum compactness, simplicity and operating convenience, coupled with extreme ruggedness. Available in two types . . . the N-1 with separate Buffer, KC1 solution and beaker . . . the N-2 with integral case for Buffer, KC1 solution, beaker, thermometer, etc.

BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

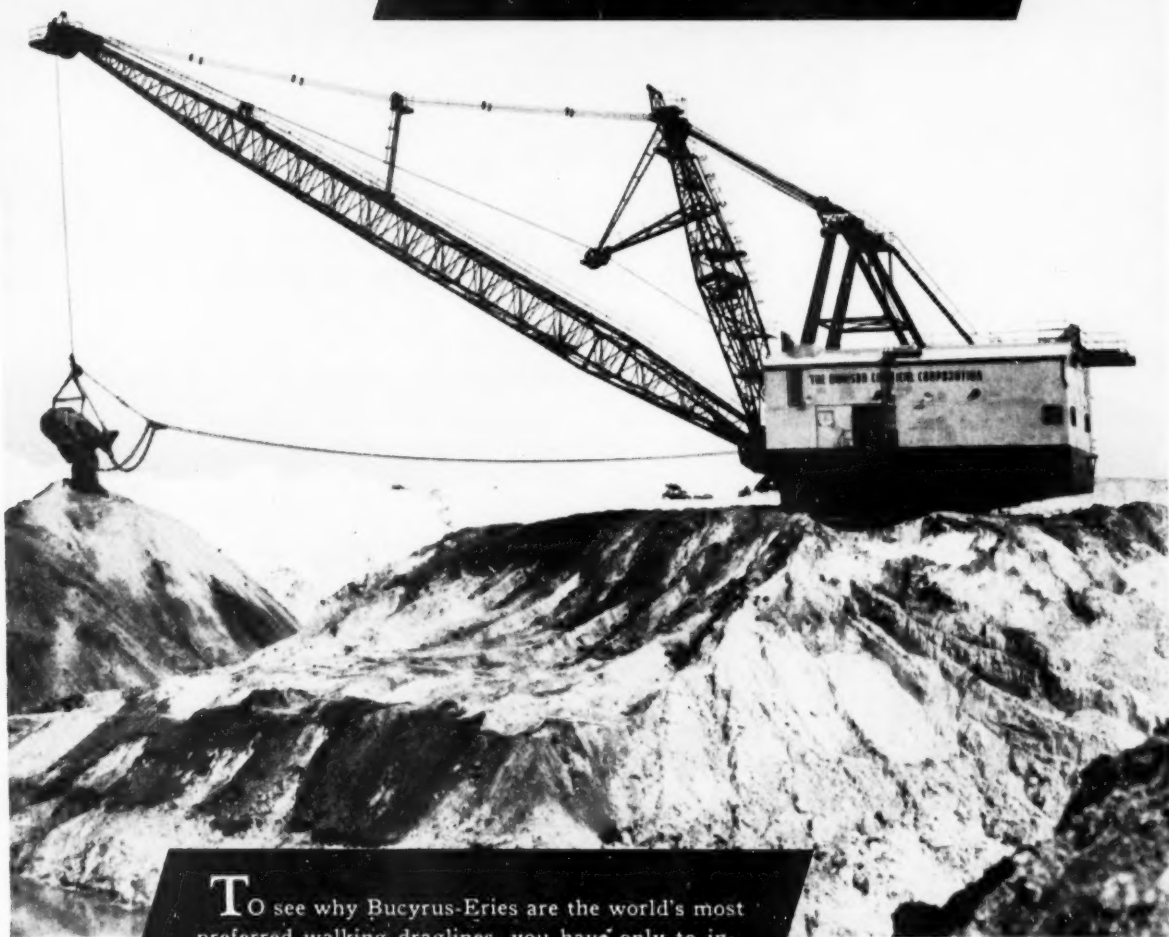
Write for literature on Beckman pH Equipment!

# Beckman division

BECKMAN INSTRUMENTS, INC.  
SOUTH PASADENA, CALIFORNIA

MINING WORLD

# Bucyrus-Erie FIRST CHOICE in walking draglines



**T**O see why Bucyrus-Eries are the world's most preferred walking draglines, you have only to investigate their record on large-scale mining operations the world over. Dependable big output; long reach; easy, accurate moveups have made them favorites for stripping jobs. The number of these machines in successful operation is a measure of their ability to cut stripping costs and to deliver big yardages with top economy.

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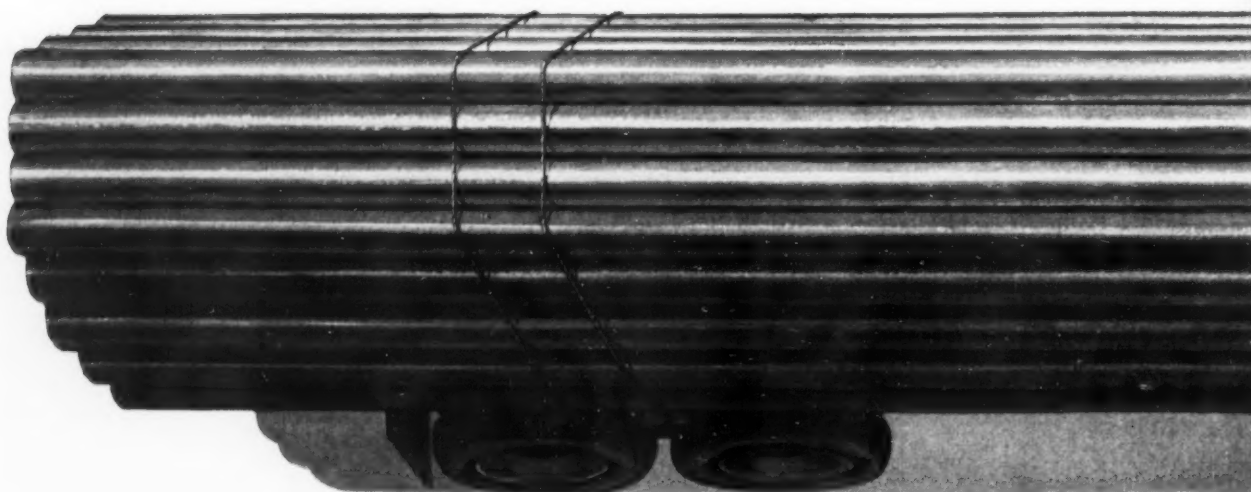
*The 650-B, shown here, is equipped with booms up to 215 ft. long. One of the largest Bucyrus-Erie electric Walking Draglines, it has individual hoist and drag drive motors, twin drag ropes, and Ward Leonard variable voltage rotating control.*

**BUCYRUS  
ERIE**

**BUCYRUS-ERIE CO.**  
South Milwaukee, Wisconsin

# If you operate medium heavy-duty trucks ...

This new 150 h.p. diesel now makes Cummins



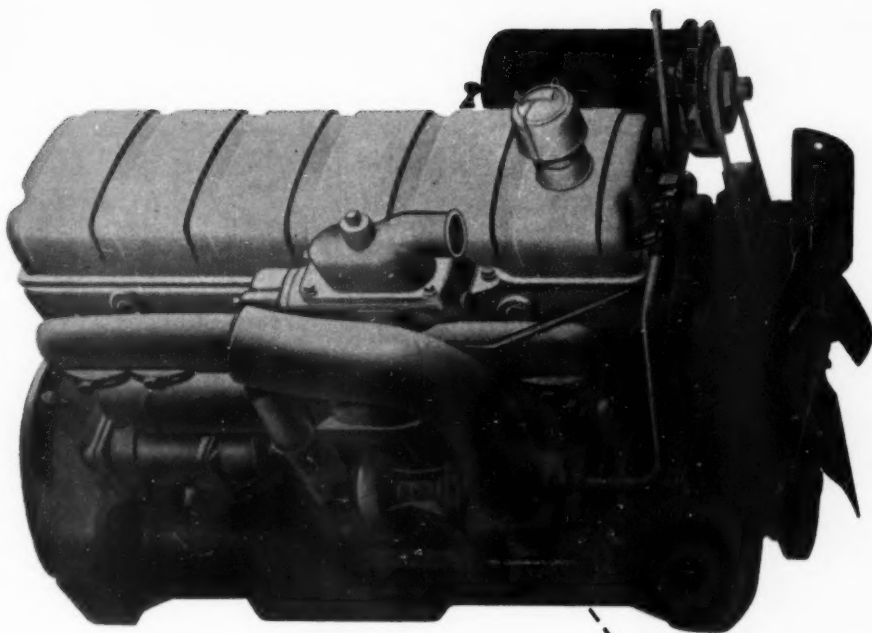
It's Cummins new Model JBS-600—ready to serve in the medium heavy-duty trucks produced by leading manufacturers. Ready to bring to this field the performance that has made Cummins the leader among high-output diesels. 150 h.p., the JBS-600 delivers full rated power for faster acceleration . . . for reserve stamina when the going is tough.

JBS-600 operators report more miles per gallon . . . lower fuel costs. This demonstrates the fact that Cummins' exclusive fuel and injection system—together with four-cycle operation and use of inexpensive Number 2 diesel fuel—naturally leads to savings on the job. The JBS-600 is ready to work profitably for you. It's Cummins-engineered for a long and useful life.

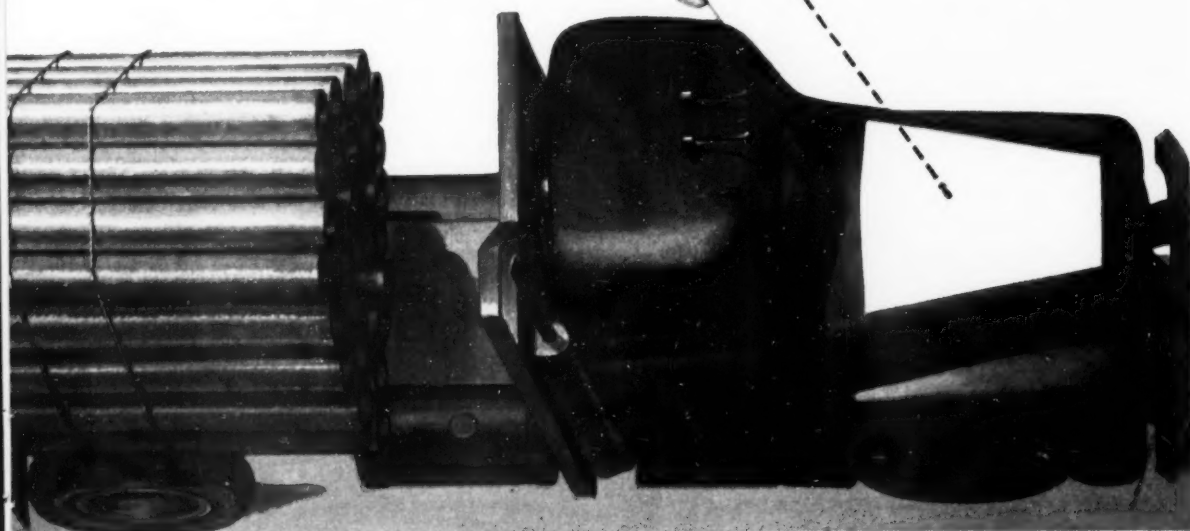
**CUMMINS**

Leaders in rugged, lightweight, high-speed diesel power





**performance and economy available to you**



# Cummins®

Engine Company, Inc. • Columbus, Indiana

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(6-2-53)



## Taconite Ores

presented new and difficult filtration problems.

## Taconite Mills

found in Oliver United's Mining Division an experience with and knowledge of filtration that proved invaluable in working up the best filtration method.

This competently staffed division of our company was asked to undertake the study of the new and unusual filtration problems presented in the preparation of Taconite Ores. Our engineers spent well over a year in the Mesabi District working on Taconite. Our engineering representatives worked in the Norway area on the same problem. We provided several different filter types for pilot plant testing operations. We initiated and carried on much of the pioneering work on taconite filtration. We followed through to a successful conclusion. Large tonnages are now being handled on Oliver Continuous Vacuum Filters. Other units are being installed.

Taconite is merely the latest in a long list of filtration developments not only in mining but in processing where Oliver United has taken a leading part in developing the procedures and filter type variations so that the many different products could be properly filtered.

The reason Oliver United is so frequently called on in connection with filtration problems is simple. It offers that rare combination of very broad filtration experience, expert development engineers and the largest variety of filter types from which to select.

Photographs above show the battery of five 8'x16' Oliver Filters handling Taconite concentrates at Sydveranger in Norway and a general view of the mill. Moisture in the cake here has to be reduced to 6% or less because of shipping restrictions.



Bulletin M-20 gives details of the several different types of Oliver United filters for handling ores and other metallurgical products.

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# OLIVER UNITED FILTERS



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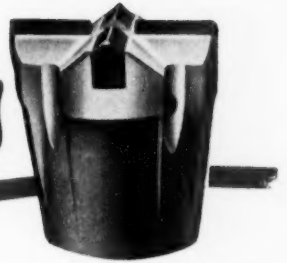
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*Everything you need for*

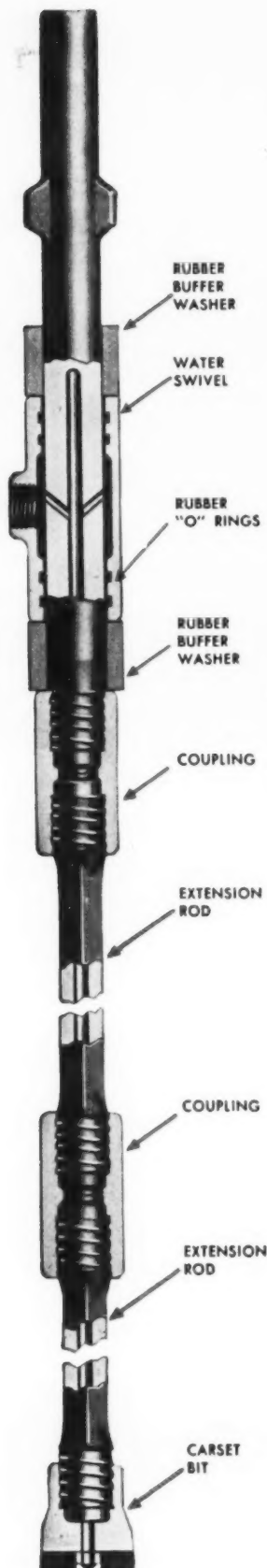
# LONG HOLE DRILLING

WITH

*Carset Jackbits*



Holes up to 100 feet deep  
are now being drilled faster  
and at much lower cost  
by this I-R Carset method



The longer-lasting, faster-drilling Carset Jackbit, with practically no gauge wear, has revolutionized deep hole drilling with I-R Drifters and coupled steels. The Carset method is not only much faster, but less costly than when using diamond drills. No special training is needed and the work can be done by regular miners with a minimum of supervision.

To permit the most efficient deep hole drilling with I-R Drifters and Carset bits, Ingersoll-Rand has developed and perfected a *complete line* of accessory equipment—including a water swivel that feeds hole cleaning air and water at high pressure directly into the drill steel without going thru the drill—a rugged, long-lasting coupling with the same threads as the bits—and extra-strong alloy steel extension rods.

This combination of equipment, shown at the left, has proved remarkably successful in a host of deep-hole drilling applications. Ask your nearest I-R representative for the complete story. He can supply *everything you need*—from the bit all the way back to the compressor.



**Ingersoll-Rand**  
11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS  
CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

954-15

OCTOBER, 1953

39

# ALLIS-CHALMERS HD-15

## a big production tractor for mining

In weight and power, the HD-15 is in a class by itself . . . with its ability to handle the toughest loads . . . its strength with exceptional margin of safety . . . its ample reserve power for big-capacity dozing or to pull big scrapers.

The HD-15 builds up greater drawbar pull faster, holds it longer. This means more lugging power, more work done. For instance, when rough going pulls travel speed down to 40 percent, the HD-15 increases its drawbar pull almost 20 percent over rated pull. This means less shifting . . . more time at work . . . more work done.

With a long track on the ground, the HD-15 provides better traction over all kinds of terrain . . . surer-footed, perfectly balanced, easily maneuvered.

*Investigate the unusual "pounds pull" of the HD-15 as shown by authoritative test.\**

\*University of Nebraska Test No. 464.

### Check These HD-15 Features

Weight, 27,850 lb. (Bare):

Approximate Weight with  
Logging Guard Equipment,  
Canopy, Winch and Stand-  
ard Dozer — 39,179 lb.

109 drawbar hp.

Exclusive Shift Pattern:

6 forward speeds to 5.8 mph.  
3 reverse speeds to 4.3 mph.

Amazing Stability:

Track tread, 74 in.  
Length track on ground,  
8 ft. 5/16 in.  
Number track shoes — each  
track, 38  
Ground pressure (lb. per  
sq. in.) 7.23

Unit Construction:

Major assemblies removable  
without disturbing  
companion groups.

1,000-Hour Lubrication for  
truck wheels, idlers,  
support rollers.

Hydraulic Steering



**BULLDOZES.** With cable-controlled bulldozer, this HD-15 moves rock and dirt. All-steel welded construction . . . unit assembly . . . 1,000-hour lubrication period of truck wheels, support rollers and idlers provides easier servicing, means less lubrication time, more work done.







**PULLS, PUSH-LOADS SCRAPERS.** Working in pairs, HD-15's load a scraper to heaping capacity. With more track on the ground, these tractors provide better stability, sure-footed traction in soft materials.

**CLEARs RIGHT-OF-WAY.** HD-15 with hydraulic bulldozer clears trees, brush and rocks prior to grading work. Two-cycle diesel engine provides 109 drawbar hp. for big load capacity and great reserve power.

**LOADS TRUCKS.** With 3-yard hydraulically controlled bucket, HD-15G efficiently loads trucks. Exclusive shift pattern saves time on loading cycle . . . you go from *any* forward to *any* reverse speed with one simple shift of gear lever.



**SEE YOUR ALLIS-CHALMERS DEALERS FOR COMPLETE DETAILS . . .**

**ALLIS-CHALMERS**  
TRACTOR DIVISION - MILWAUKEE 1, U. S. A.

# *- Drifts and Crosscuts -*

**Russian Economic Warfare**—No one knows what is behind the recently evident Russian trade offensive which has been developing concurrently with the new Russian peace campaign since Malenkov's ascendancy to power. Is it more than a chance happening that more and more offerings of Russian-produced minerals are being made on the world market fronts? Russia and France have signed a three-year Trade Agreement whereby the Russians will export manganese, chrome, and asbestos in exchange for strategic material from Western countries.

It is not at all inconceivable that a ship load of Russian manganese or chrome might appear unannounced in some eastern seaport. Apparently there is nothing to prevent sale of these minerals in the United States despite the ban on their export to countries behind the Iron Curtain in accordance with the United States Battle Act. Unfilled contracts for manganese ore from Russia are held by American steel producers, although it is doubtful if Russia would honor them in view of today's prices which are considerable higher than when con-

tracts were executed.

What about Polish zinc? Again no one knows. Poland has announced plans to produce 200,000 metric tons of zinc annually by 1955. The ore is there and production costs bear no relation to those in the United States. Already Poland is stepping up its drive to export zinc oxide through the "Impexmetal" and "Minex" National Enterprises.

Will the Korean cease-fire lead to peace and resumption of trade with China? If so, will there be a dumping on United States markets of antimony and tungsten? China has been the world's largest producers of these strategic metals in years past, and apparently still is—with output largely going to Russia.

The Russian Trade Offensive might be designed to slow Free World mineral production. Every time a mine is closed, no matter the cause, it is a slow and costly process to reopen it. It is fortunate that Congress had the insight to provide a guaranteed market for domestic tungsten, manganese, chrome, and asbestos producers for an additional two years.

**Activity Abroad**—Manganese is of growing importance in southern Africa. . . . First overseas shipment of high grade manganese from Northern Rhodesia has been made. . . . Geological surveys are continuing. . . . In the Northern Cape Province ore bodies west of any yet developed in the Postmasburg district are reported. . . . Annual district production has been about 600,000 tons from an irregular bed between a dolomite footwall and shale and quartzite hanging wall. . . .

**Mining Methods**—Mining of uranium and vanadium by leaching-in-place has been under experimental study for the last two years. . . . Tests have been made in both Colorado and South Dakota. . . . The ore minerals are found in flat dipping sandstones and shales. . . . Often cementing sand grains. . . . A leach solution is introduced into ore horizon and pregnant solution recovered for precipitation recovery of minerals. . . . Solution circulation is a problem. . . . Tools such as "Sandfrac" and "Hydrafrac" might be borrowed from the oil industry and modified for uranium formation use. . . . The systems fracture low-solubility formations. . . . Special "propping" agents hold the formation open to solutions. . . . Pre-fracturing treatment to lower formation pressure is often used. . . . Leaching-in-place developments are only beginning. . . . Copper leaching-in-place from block caved ore also in the news from Arizona. . . . DMPA is backing this new method with a purchase contract for 5,500,000 pounds of copper from the Copper Creek Consolidated Mining Company. . . . Copper will be recovered from the Old Reliable mine in Arizona's Bunker Hill district. . . . Research into the uses and life for underground timber continues in South Africa. . . . A preservative mixture of copper sulphate and sodium bicromate indicates lengthened timber life. . . . A fire retardant coating for shaft timber has been

developed and is being tested for durability under service conditions in operating shafts.

**Treatment Trends**—Experiments in the use of a cyclone in place of a bowl classifier in the secondary grinding circuit at a South African gold mine have been successful. . . . At Rand Leases (V) Gold Mining Company, Ltd., a test unit separated 700 tons per day of 70 percent minus-200-mesh slime from a feed of 1,900 tons of 35 percent minus-200-mesh pulp. . . . Feed was 50 percent solids. . . . The Cyclone operated at a five-pound-per-square-inch pressure. . . . Greatest disadvantage was the lack of visual indication of the coarse products being recirculated for regrinding. . . . So successful has been the application at Rand Leases that two other Witwatersrand gold mills are making tests. . . . First cyclone in the gold-uranium mills of the Orange Free State is at Virginia Orange Free State Gold Mining Company, Ltd. . . . ¶Here in the United States a variety of bugs make news. . . . Bugs (or microbes to the bacteriologists) continue to give indications of being the newest metal refining tool. . . . The Kennecott Copper Corporation has given much publicity to work of bugs at its Utah Copper Division in recovering copper from leaching dumps. . . . Now a similar bug has been found which is separating molybdenum on a laboratory scale. . . . Mercury can also be bug-separated. . . . Apparently no one has tried bugs on uranium recovery. . . .

**Domestic Developments**—Ralph MacKay, 2923 East Harrison Street, Seattle 2, Washington is collecting "Cousin Jack" stories of early days in the mining camps in the west. . . . So far he has collected more than 50 and is looking for more for publication. . . . He is an old timer who collected many of the stories personally during his work in Butte.

***After 12 years,  
they wanted more of the same***



**T**HE busy Caterpillar HT4 Shovel loading rock in the National Gypsum Co. mine, Sun City, Kan., is following in its own footsteps.

Explains Sam J. Shepler, mine superintendent: "We had a D4 Traxcavator for 12 years and replaced it with this HT4. That should be a good recommendation."

You're right, Mr. Shepler. There can be no better recommendation in our business than that of a satisfied customer.

The shovel, utilizing its easy maneuverability and small work space requirements, is cleaning up extra rock on the mine floor which a giant loader can't reach.

But that's only one use for this all-around unit. It is designed to do your loading, digging, backfilling, leveling and grading jobs. You'll never run out of work for this work-happy Caterpillar Shovel, and it always will be ready to work when you are.

Ask your Caterpillar Dealer to show you this shovel's

box-section, all-welded lift arms. See for yourself how its girder-type, all-welded frame is mounted low and close to the rollers to keep the load off the transmission and tractor frame. Notice how a spacer bar between the lift arms prevents twisting and bending of the lift and bucket control arms and bucket hinge pins.

You'll quickly be convinced that you are money ahead with a Cat\* HT4 Shovel.

Caterpillar Tractor Co., San Leandro, Calif.; Peoria, Ill.

**CATERPILLAR\***

\*Both Cat and Caterpillar are registered trademarks—®

**NAME THE DATE...  
YOUR DEALER  
WILL DEMONSTRATE**





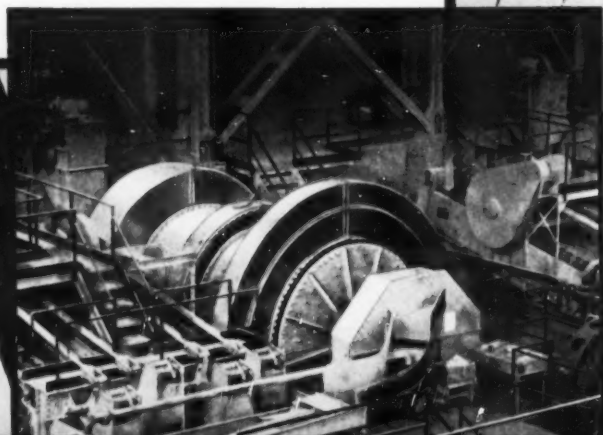
# SMIDTH

## ROTARY KILNS

For sintering, nodulizing, calcining, desulphurizing and oxidizing and reducing roasting—also coolers, pre-coolers, preheaters, recuperators—and their accessories.

## GRINDING MILLS

Ballmills, tubemills and multi-compartment mills—wet or dry grinding—open or closed circuit—also air swept for grinding and drying.



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## CAPITOL CONCENTRATES

### NOTIFY TARIFF COMMISSION TO TESTIFY ON PB-ZN MINES

Acceding to a request from western congressmen as expressed in a joint resolution, the Tariff Commission has announced that it will open hearings in Washington, D. C. on November 3, 1953, to give domestic producers and consumers of lead the chance to present their views on conditions in the the industry. Zinc producers and consumers will get their chance November 5. The Tariff Commission has advised all persons who are interested in the lead and zinc import question to give notice to the Secretary of the Commission in writing of their desire to be heard.

#### • Any Suggestions For SEC?

Chairman Demmler of the Securities and Exchange Commission reports that the commission is conducting a review of its rules and forms "with a view to simplifying them wherever that can be done consistently with its statutory duties to protect investors." As a result, he said, the commission will welcome any suggestions for changes in its rules and forms, as well as changes in the legislation under which it operates.

#### • Bar Association Given Mining Report

The American Bar Association, meeting in Boston on August 25, was alerted to conditions within the hard minerals industry by Raymond B. Holbrook, attorney, United States Smelting, Refining and Mining Company, Salt Lake City. Holbrook said:

"In 1935, there were 11,181 producing nonferrous mines in the western United States, and by 1950 only 1,847 were in operation. Today those operating on a commercial basis could be numbered in three figures."

Holbrook, who is chairman of the association's Hard Minerals Committee, stressed the importance of pending legislation which would change the mining laws as they apply to the location of mining claims. He outlined provisions of the D'Ewart and Hope bills, which have been approved by the House Interior and Agriculture Committees, respectively, and will be considered by the House Rules Committee when Congress reconvenes. He also reviewed proposed tax and labor legislation and told of the scheduled Tariff Commission investigation into the effect of imports on the domestic lead and zinc industries.

#### • McCarran Offers Novel Plan

Shortly before Congress adjourned, Senator Pat McCarran introduced S. 2514, which he terms the "Sound Money Act of 1953." This act would change the price of gold, not to some arbitrary figure, but to a value "where it accurately reflects the depreciation that has taken place in the United States since 1933 based upon the wholesale commodity index," and the price of silver is to be fixed by Congress "where it reflects the correct ratio between gold and silver based upon the relative world production of these two precious metals since

1492." The bill would also restore free coinage and convertibility with the paper currency.

McCarran's bill is an interesting approach to fixing the price per ounce of gold. Since the government has been monkeying with the commodity indices lately, the point may be raised as to which index should be used, but this could be determined readily. Why the year 1492 was picked as the starting date for the gold-silver ratio determination is a little obscure but, knowing McCarran, one can guess that silver producers will not suffer thereby! The bill seems to make a lot of sense.

#### • House Committee Amends Assessment Bill

In amending the Senate bill S. 2320, the bill to change the assessment work date from July 1 to October 1, the House Interior and Insular Affairs Committee introduced a clause to require that \$125.00 worth of assessment work be done on each claim for the extended period—July 1, 1953 to October 1, 1954. After the normal cycle is resumed, the amount drops back to \$100.00 per claim for the new assessment year. This change was made to satisfy the Interior Department.

Assistant Secretary Orme Lewis wrote the committee: "This department has opposed repeatedly extensions or suspensions of annual mining assessment work. No one should be entitled to the possession of public lands under the United States mining laws if he does not actively prospect for and develop the minerals in such lands." Lewis further stated, "If this legislation is to be acted upon favorably, I urge that it be made very clear in every practicable way that the new statute is not intended to encourage further moves for suspension or extension of the annual mining assessment-work requirements or for other provisions excusing compliance with these requirements of the United States mining laws."

The Interior Committee of both Houses of Congress reportedly has for some time had a tacit understanding not to report favorably on further demands for suspension of assessment work.

#### • DMEA Continues Assistance Program

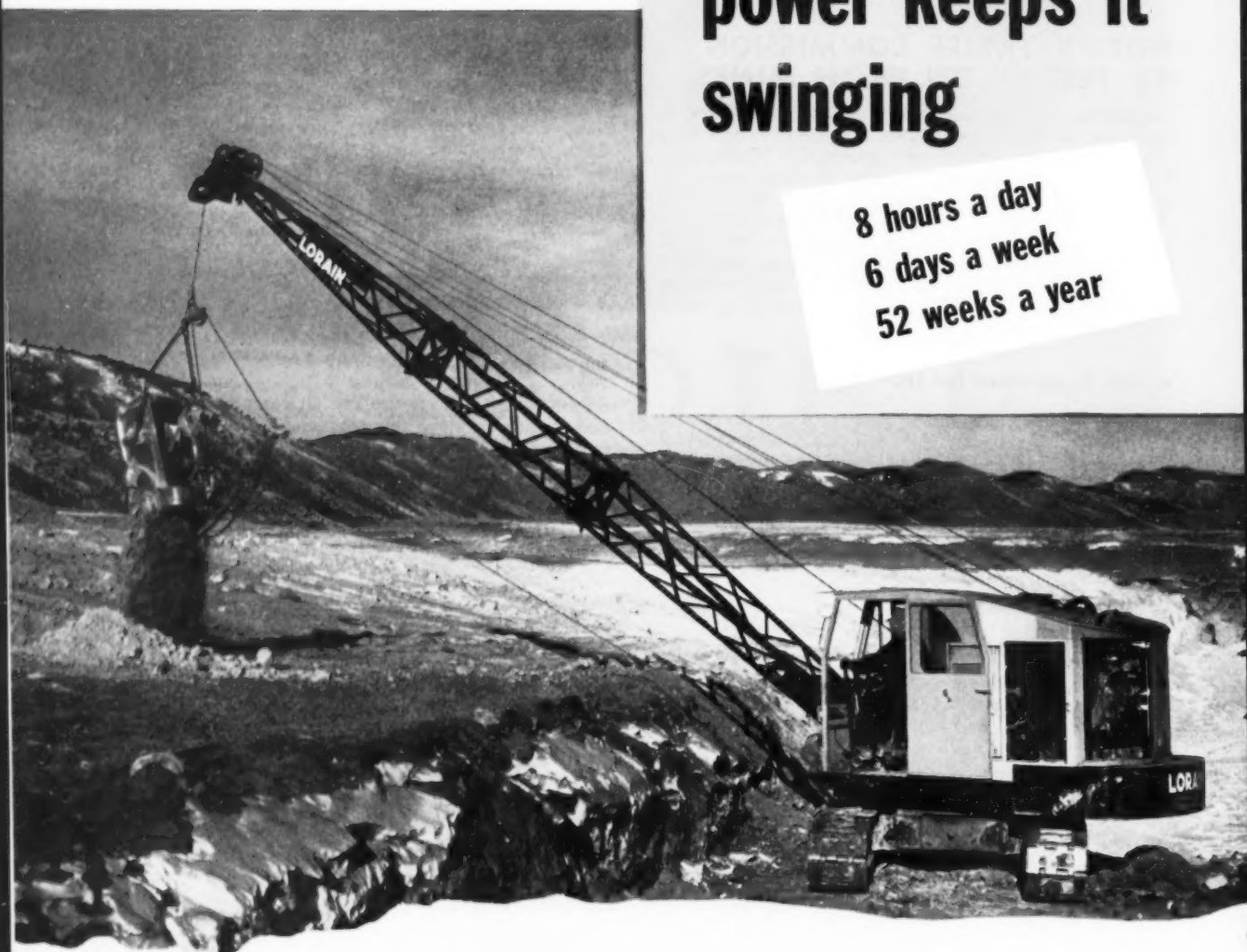
Although in June 1953 the Defense Minerals Exploration Administration announced that it would confine its matching exploration aid to exploration for chromium, copper, molybdenum, refractory-grade bauxite, manganese, tungsten, asbestos, beryl, cobalt, columbium, tantalum, industrial diamonds, mica, nickel, platinum, thorium, and uranium, its list of approved contracts for July included projects for tin, mercury, lead, zinc, antimony and fluorspar. The value of these mineral contracts dropped from assistance list under Amendment No. 2 to DMEA Order 1 was slightly over \$230,000. No doubt the contracts already were in process at the time the order was issued restricting the number of eligible metals and minerals.

DMEA's July contracts were said to amount to \$1,082,859 of which the government's share is \$632,924.

May we remark again that while this program is too restricted in scope, and is to a great extent ham-strung by the matching-funds requirement and the prohibition

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against doing development work of any kind, it has been and is generally the best administered of any of the recent emergency mineral programs. Administrator Mittendorf richly deserved the merit citation given him recently by the Interior Department.

#### ● Mexican Manganese Contracts Are Criticized

Representative William D. Mills of Arkansas, author of a number of bills designed to build up the domestic manganese industry, complains publicly that the Mexican manganese purchase program recently entered into by the General Services Administration is much more liberal than the domestic purchase program. The Mexican program is designed to aid more than 100 mines, some as far as 1,000 miles below the borders. Representative Mills says, "Questions of discrimination are being raised by producers and rightfully so. The situation warrants a full-scale investigation of these complaints by the new administrator of the Defense Materials Procurement Agency, Edward S. Mansure, before the Congress itself is called upon to do so at the next session.

#### ● USGS Operations Under Study

The United States Geological Survey, which has been left strictly alone for some years, appears to be the next bureau to receive attention from the Administration. A six-man commission has been appointed by Interior Secretary McKay to study the USGS operations and organization and report to him suggestions for improving the agency by December 15. The Bureau of Mines needs such a study much worse than does the Geological Survey.

#### ● No Reply From Flemming

Before the close of the Congress, a member of the Senate Interior and Insular Affairs Committee wrote ODM Director Flemming suggesting that the lead-zinc industry could be saved by making government floor price contracts. Up to the end of August Flemming had not even bothered to reply.

#### ● Control Lifted On Many Minerals

The National Production Authority gradually has reduced its control list and now has it down to a few minerals. These are: aluminum, asbestos, beryllium, copper, cryolite, industrial diamonds, fluor spar (acid grade), magnesium, manganese, mica, platinum, selenium, titanium, tungsten, vanadium and zirconium. It seems a little strange to find magnesium still on the list when the government has just closed five of our six producers.

### COMING CONVENTIONS

October 15 to 17, 1953. NATIONAL CLAY MINERALS CONFERENCE, sponsored by the National Research Council. University of Missouri, Columbia, Missouri.

October 19 through 23, 1953. The 41st NATIONAL SAFETY CONGRESS AND EXPOSITION (mining sessions afternoons of October 19 and 20). Conrad Hilton Hotel, Chicago, Illinois.

October 28 through 31. INTERNATIONAL MINING DAYS sponsored by the New Mexico Mining Association and the Mining Committee of the El Paso, Texas Chamber of Commerce, El Paso, Texas.

December 2 to 4, 1953. MIDCENTURY CONFERENCE ON RESOURCES FOR THE FUTURE, Washington, D. C.

January 28, 29, and 30, 1954. Annual meeting of the COLORADO MINING ASSOCIATION. Shirley Savoy Hotel, Denver, Colorado.

OCTOBER, 1953

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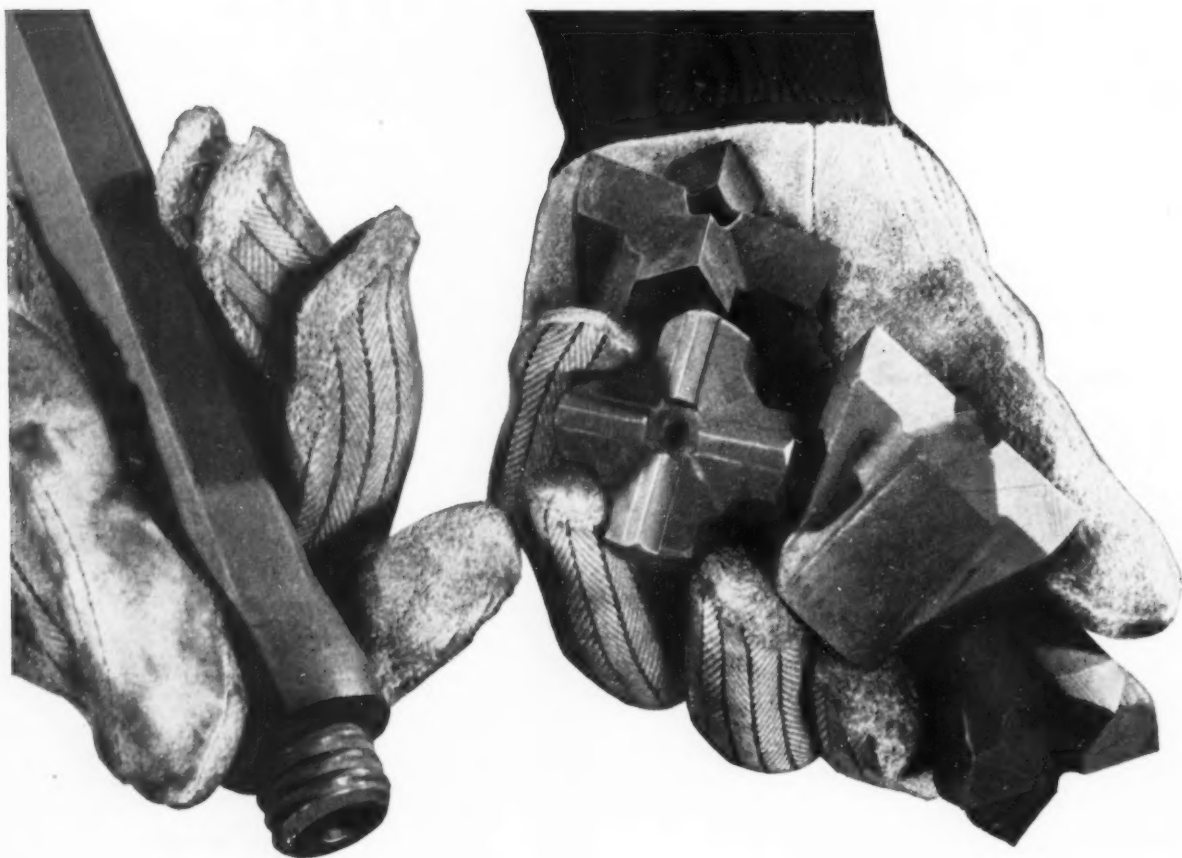
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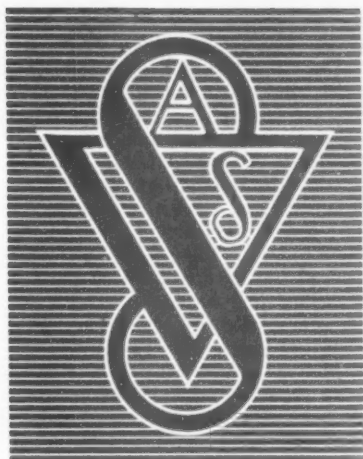
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MINING WORLD





# THE *Sydvaranger* STORY

**World's First Commercial Taconite Operation Is Proving Ground For Future Mesabi Developments**

Sydvaranger—250 miles beyond the Arctic Circle and only 1,200 miles from the North Pole—is important to many different people for many different reasons. It is interesting to many thousands more because of the combination of reasons which make it so important.

In Norway Sydvaranger is of vital interest because it represents about one-sixth of that nation's mining industry. All of its production is exported, and its volume of foreign trade helps raise the standard of living of Norway's 3,000,000 people.

To the iron producing industry of the United States, it is important because it serves as a development laboratory for metallurgical practices that may be adapted, to a substantial degree, in treating the taconites of Minnesota. It also serves as a proving ground for big equipment required in handling this toughest and most abrasive of iron-bearing ores.

Manufacturers of mining equipment throughout the world feel Sydvaranger is important because knowledge acquired there can be engineered into machinery for the multi-billion dollar taconite plants soon to be built in America.

To MINING WORLD the project was important enough to send an editor over 10,000 miles to study the operation because it was felt that mining people everywhere should have a record of the facts available for their use.

As for interest, parts of the Sydvaranger story read like a story book. Taconite concentrate has been made and marketed since 1910. Forty-three years ago taconite briquets were successfully produced. Sensitive to economic conditions and hampered by wars, the operation

has had its troubles. The final blow—possibly a blessing in disguise—was the Nazi "scorched earth" policy. When the Germans retreated from Norway, Sydvaranger was bombed and burned to rubble. Not a piece of machinery, not one electric motor was left undamaged. Since complete rebuilding was all that could be done, the plant is now one of the finest and most modern in the world.

Ore, at the present site, was first discovered in the 1860's. Operating licenses were issued in 1902 and

Atkieselskabet Sydvaranger was formed in 1906. Construction of facilities started in 1907 and the first ore was produced in 1910. The building was financed principally by German capital, and the Germans sent a 25-year old banker, Fr. H. Behrens to Norway. He became the company's managing director in 1911, and held that position until July 1, 1953 when, at an age of 70, he retired and was elected vice-chairman of the board. Mr. Behrens became a citizen of Norway in 1917. The King of Norway has





The Public Quay at Kirkenes is built out over the Varanger fjord. The main channel to the North Sea is in the left background. All freight and passenger vessels for Kirkenes load and unload at this quay. A/S Sydvaranger's inbound freight and outbound concentrate are handled over separate docks.

awarded him the Knighthood of St. Olav for his outstanding work. J. Kraft-Johannsen, the technical director who supervised the rebuilding program after World War II, was named managing director to succeed Mr. Behrens.

In the early days, the future looked bright for A/S Sydvaranger, but the first World War hindered the export of ore. Norway then made an agreement with the United States not to export to Germany. Work stopped until the war was over. The financial structure crumbled, refinancing was necessary, but prosperity returned gradually and in 1935 dividends were being paid again.

World War II rolled over Norway and over Sydvaranger. At German insistence, production, of a sort, was maintained during part of the occupation, but little or no product was shipped to Germany. Then the bombs fell. Russian bombers swept in from the east. Bombers of the other allied nations appeared from the west. In all, there were 1,012 air raid alarms and 328 bombings. Next to Malta, Kirkenes claims to have had the most airraids of any place in Europe. When "Festung Kirkenes" (the Germans had heavily fortified the area with a circle of heavy concrete pill boxes, anti-aircraft emplacements, etc.) fell before the advancing Red Army, the "scorched earth" policy went into effect. Less than a dozen houses were left standing. What remained after the bombing was put to the torch. Kirkenes, the mining town of Bjornevatn, and other tiny spots in the area were gone.

At the mine and mill, some of the buildings and equipment had been

severely damaged by the bombings. After the liberation not one whole piece of equipment remained. Nearly all of it was beyond repair as a result of dynamite and fire.

The restoration was a gigantic task, but it has been handled with remarkable speed. Of course, houses and business buildings are still being erected, and there is still a housing shortage. On the other hand, the mine and mill have reached the planned capacity-rate of operation. The population of Kirkenes is now about 3,600; of Bjornevatn, nearly 1,000.

The restoration took money; a lot of money. For reconstruction of the Sydvaranger plants, 130,000,000 Kroner (\$18,000,000) has been spent. When rock stripping costs (before production was resumed) and operation capital are included, a total of 176,500,000 Kroner (\$21,450,000) has been invested.

The company's own funds were 35,500,000 kroner; 133,000,000 came from loans guaranteed and stock purchased by the Norwegian Government, and the remaining 8,000,000 kroner came from ore sales. About \$4,000,000 (U.S.) in Marshall Plan funds is included in the total. It should be remembered, however, that the latter was aid to Norway, and it provided no financial assistance to the private mining company.

The district of Sydvaranger is situated in the county of Finnmark, the most northeasterly area in Norway. To describe it as bleak or barren is not quite accurate. It might be more accurately described as a little bit of both. The rough terrain is almost solid rock. Little natural vegetation grows except in sheltered areas, and the thin, poor soil

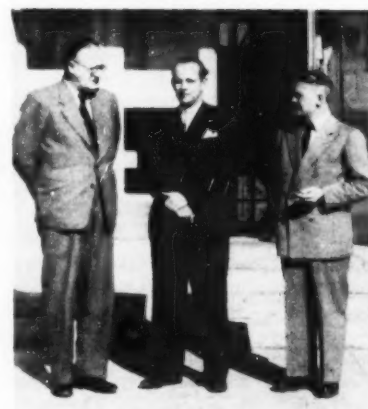
makes farming difficult. Agricultural production is extremely small.

The climate is severe, but not bitterly cold as one might expect in this far north. The tempering influence of the Gulf Stream holds temperatures between minus 30° and plus 80° F. with an occasional short summer "hot spell" reaching plus 90°. Rainfall is 15 to 19 inches annually, and, while snow is on the ground for long periods of time, it is seldom very deep; in fact, the climate would be more desirable than that in the Iron Range country of Minnesota except that the winter is extremely long and there is almost no daylight for many weeks of the year.

In 1910, when the original plant was built, it was the last word in modern design and performance. By 1953 standards, as reflected in the rebuilt plant, it was rather inefficient and wasteful. Metallurgical results, however, were surprisingly good.

Ore in the open pit was broken by "coyoting"—that is, tunnels were driven horizontally into the bench toe. Crosscuts from these tunnels were filled with powder, sealed, and fired. Ore was loaded by Marion steam shovels and transported to the two, 36-inch, Allis-Chalmers gyratory crushers, and from there, by railroad, to the mill at Kirkenes. A row of small jaw crushers and, in later years, three 7-foot Symons cone crushers, provided feed for 32 6-by 6-foot ball mills which, after a first magnetic separation step, were followed by tube mills, final magnetic separation, and acres of drainage basins and storage bays with large overhead cranes handling

Karel Wegkamp, MINING WORLD's iron ore editor who flew to Norway from the United States to obtain "The Sydvaranger Story," is shown in the center as he was welcomed to Kirkenes by J. Kraft Johannsen (right) managing director, and Hans Torgersrud, works manager.



the concentrate with clam shell buckets.

While the mine, today, has been converted to churn drilled vertical blast holes and truck haulage to the coarse crusher, the principal changes at the mill have been in the size and design of equipment. The basic flowsheet has remained almost the same as previously.

The detailed story of Sydvaranger, its operation and its problems, its techniques and conclusions—as reported in succeeding articles in this issue—are similar in nature to those of any other difficult mining operation. One factor, however, is different. The mine lies about two kilometers from the Russian border. The “invisible Iron Curtain” lies along the main channel of the Pasvik River which forms about 80 miles of boundary between Norway and Russia. This was formerly the Norwegian-Finnish border. “The curtain isn’t visible, but it is there.”

How do the people of Norway feel about America?

They are definitely pro-American and pro-Western. This was especially noticeable among the men of Sydvaranger. During the reconstruction period 18 different staff members visited the United States. Some of them made several trips. They are lavish in their praise of the help and cooperation extended to them by the mining people of America. Management made a point of stressing that, “so much of what we have planned and done we owe to what we have seen and learned on our visits to the mining districts of your country.” MINING WORLD was asked to make public an expression of appreciation for this help.

As for the industrialist, the shopkeeper, and the man on the street, they too are pro-American and friendly to the United States. There is little criticism of the United States foreign policy, and it was interesting that the questions most frequently asked were: Why do the Americans give all of this money to help other countries when they can never get anything in return? Why do you help build up industries in other countries so that they can take your markets away from you?

It is doubtful that much impact was made by the discussion of mutual economic advantages of a world made up of strong nations. There is no doubt that all understood, and believed, that the real reasons are that Americans, too, are a friendly people and that they really want to be good neighbors.

OCTOBER, 1953

## THE MEN OF SYDVARANGER



J. KRAFT JOHANSEN



FR. H. BEHRENS



A. A. SANDAKER



WORM LUND



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Typical section of the east pit showing both the foot and hanging walls. The tunnel in the center leads to the north pit on whose edge the primary crushing plant is located.

## SYDVARANGER GEOLOGY

# Ore Body Is Quartz-banded Magnetite In High-Dip Metamorphosed Sediments

By JENS A. W. BUGGE  
Geologist

Sydvaranger's ore is a true taconite—quartz-banded magnetite. It is nearly identical to some types of magnetic taconite found in the Iron Ranges of Minnesota as shown in accompanying box.

The Sydvaranger taconite may be slightly more crystalline, and that may affect drilling and grinding characteristics slightly. It is also slightly higher in iron content (30 to 36 percent versus 24 percent for Minnesota). But in hardness, abrasiveness, and fineness of dissemination, the two are closely similar.

### The Bjornevatn Series

All current production comes from the Bjornevatn (Bear Lake) orebody, about five miles south of Kirkenes harbor. The Bjornevatn is in a tight, overturned, plunging fold, cut by dikes and faults. In plan, the orebody is a "V" with a 35° angle between the legs, and with its point toward north. The ore zone ranges from 15 to 170 meters (49.4 to 558 feet) in width; both legs normally dip from 60° to 80° east.

In the part exposed by open-pit

mining, the western leg of the "V" is approximately 1.5 kilometers (0.7 miles) long; the eastern leg is about 1.0 kilometers (0.45 miles) long. Mining width (horizontal) of both legs varies from 40 to 170 meters (13 to 558 feet).

The ore deposits are metamorphosed sediments in the Karelian formation (middle pre-Cambrian). Primary iron minerals were probably siderite, hematite, and iron silicates; the interbanding silica was probably precipitated in colloid form.

These minerals have been completely recrystallized into magnetite, biotite, amphibole, and quartz. The quartz and iron-ore bands are usually a few millimeters thick (0.1 inch or so).

Geologists have found no secondary enrichment except at the Kjellmannasen mine. There, iron ore averaging 50 to 55 percent was formed by hydrothermal alteration near the border of a diabase dike.

The entire district is about 7 miles long and 3 miles wide. On the east and west, it is bordered by faults. On the north and northeast, it borders on ancient Svionian granites. On the southwest, the ore series disappears under more recent rocks of the Petsams formation.

The beds are in tight folds whose axis pitch slightly to the south-southeast. Overturning of the east limb is common. The major folds are complicated by later shearfolds whose axis pitches eastward.

More recently, perhaps in Caledonian time, diabase dikes about 0.5 to 10 meters (1.6 to 33 feet) thick intruded the ore beds. They usually strike N. 25° to 45° W., and dip 45° northeast; but a few strike northeast. The orebodies are cut by faults parallel to these dikes, the hanging walls of which have moved downward.

Finally, the series has been cut by two systems of faults—one which strikes N. 5° to 10° W., and one which strikes N. 50° E.

In total, these features condition form and delimit an orebody which

### Age Relations of Rocks

Feature	Age
Faults	Caledonian Cycle (?)
Diabase dikes	
Granites, granitization & orogenesis	Karelian Cycle (Huronian)
Biotite-amphibole gneisses (meta-andesites)	
Iron sediments	
Bjornevatn gneiss (quartzites and meta-rhyolites)	
Bjornevatn conglomerate	Svionian Cycle (Laurentian)
Gneiss-granite, gneiss & amphibolite	



requires expert geology, exploration, correlation, and mining control.

### Exploration Continues

The major orebody was thoroughly test-drilled and outlined years ago insofar as the pre-war mining plans were concerned; but with the recent plan to go deeper by open-pit methods and to increase production, additional data were required. Since the end of World War II, some 25,000 feet of diamond drilling has been done. The summer program for 1953 included an additional 10,000 feet.

The purpose is to definitely delimit ore on certain levels and to check records of previous work. The results are being used to lay out the underground mining system that will be getting into the preliminary stages in about 15 years. In 25 years mining probably will be entirely underground.

Sydvaranger does all of its own drilling and operates a pair of Long-year Straightline Junior drills, powered by Waukesha gasoline engines, on a two-shift basis. These machines have been eminently satisfactory, and special devices for holding drill rod during the pulling and lowering operations have been developed at the mine.

Two types of EX core bits are in use currently. Most drilling has been done with a so-called "powder" bit, which has very tiny diamonds cast in a matrix. These bits are always used in ore because it is so difficult to drill that bits with larger diamonds wear away rapidly and bit costs are excessive.

The "powder" bits must be re-sharpened by sand blasting every two meters and they are drilled to destruction in about 75 meters (246 feet). Drilling speed is between 8 and 15 meters per shift with the average probably 10 meters (32.8 feet).

Recently, in an attempt to increase speed, a small-stone type of bit has been used in drilling waste. After two months of experience, it seems reasonable to expect about 15 meters (49.4 feet) per shift average, but it is obvious that bit cost is going to climb.

These bits contain diamonds totaling seven to eight carats in weight and will drill about 11 meters (36.1 feet) before they need resetting. One to two carats are required for reconditioning. Both types of bit, purchased in Europe, cost about the same.

Much deep hole work is being done and 20-foot-long, EL-type core bar-

## Sydvaranger and Magnetic Mesabi Taconite Identical In Many Ways

**Sydvaranger and Mesabi Range magnetic taconite are surprisingly similar in chemical analysis, in mineralogical make-up, in hardness, in abrasiveness, and in fineness of mineral particle sizes. Both require fine grinding for mineral liberation.**

**They are different only in that Sydvaranger taconite may be slightly more crystalline and has a higher magnetic iron content.**

Percentage Analyses of Sydvaranger Magnetic Taconite and Magnetic Taconite From Three Mesabi Range Locations

Constituent	A/S Sydvaranger	Eastern End Mesabi Range	Lower Cherty Formation Near Aurora, Minnesota	Magnetic Taconite Near Mountain Iron, Minnesota
Total Iron	33.5	32.0	31.17	30.8
HCl Soluble Iron	32.5	29.2	N. D.	30.5
Magnetic Iron	30.0	25.0	21.30	21.8
SiO <sub>2</sub>	45.0	45.2	49.12	42.7
Al <sub>2</sub> O <sub>3</sub>	1.0	0.8	0.18	0.3
CaO	2.3	2.3	1.36	3.1
MgO	2.5	3.0	1.27	1.2
MnO	0.2	0.3	N. D.	0.8
P	0.05	0.05	0.025	0.025
S	0.08	0.02	N. D.	0.10

N. D.—Not determined.

rel has been adopted to replace the usual 10-foot barrel. Core recovery approaches 100 percent.

Other ore deposits in the vicinity are also being explored. Geologic mapping of the area to the south of the Bjornevatn deposit is nearing

completion and some drilling has been done.

A/S Sydvaranger is one mining operation that is definitely keeping development ahead of production. All things being equal, it should have a long, well-ordered future.

Diamond drill operators lowering EX rod into a deep hole in the east pit. The drill is a Long-year Straightline Junior, gasoline-powered.



## SYDVARANGER MINING

# U. S. Equipment Moves 3,600,000 Tons of Hard Ore & Waste Yearly

By ULF SMITH MEYER  
Mine Superintendent



Ulf Smith Meyer

From the start of mining in 1910 until the operation was destroyed in World War II, total production was 25,000,000 tons. Since reconstruction it has kept pace with mill demands and is now at planned capacity of some 200,000 tons of ore and almost 100,000 tons of waste rock monthly. The accompanying map shows the general layout of the open pit and mine buildings with the shaded portion showing ore on the 84 level. The number of a level indicates its height in meters above sea level.

Most of the current production is from the north and east pits, and orderly mining of the narrow, steeply dipping orebodies has been laid out to the minus 30 level.

Bench heights are held at 46 feet, which seems to be a safe and economical height. Earlier, 50-foot benches were used, but secondary breaking requirements increase rapidly as benches increase in height. Both ore and waste are very solid and stand well. The pit limit on the hanging wall side is planned to stand at a 70° angle. However, between each two benches (92 feet), 24-foot berms are left to catch falling rock. This makes the overall angle only 56°. On the footwall side, these berms are 33 feet, and the slope between follows the dip. Total slope angle is never allowed to exceed 56°. This appears to be adequate for safe mining.

Haulage roads are made 50 feet wide with a maximum grade of 8 percent. To keep tire costs at a minimum, roads are kept in excellent condition, and

A big Bucyrus-Erie 120-B, electric shovel loads broken ore into a 22-ton Euclid. The truck is powered by a 275-horsepower Buda Diesel engine. Bucyrus-Erie 42T churn drills can be seen working on the bench above.



Ore is drilled and broken cleanly to pit limits. Here holes are being drilled along the footwall with Thor drills equipped with Tungsten carbide tipped steel.

a Caterpillar No. 12 grader is in constant operation. Winter offers no problem as snow and ice make an excellent surfacing material giving adequate traction when temperatures are lower than minus 5° C.

The planned development will make available approximately 45,000,000 tons of ore with only 20,000,000 tons of waste stripping—a ratio of 0.45 tons of waste per ton of ore. The three sections of the pit will be mined down to minus 30, minus 2, and plus 12 meter levels in the north, east, and south pits, respectively. Then a 1.0 to 1.0 Waste-ore ratio is reached. At this point, it is planned to resort to underground mining.

### It's Hard to Drill

The ore and even the waste rock are very hard and abrasive. Drilling is most difficult, and primary breaking costs account for 30 percent of the total cost of ore delivered to the primary crusher. It is believed that the material may be slightly less difficult to drill than Minnesota taconite. Physically, the Norwegian taconite seems slightly less crystalline than the Mesabi taconite.

For primary blasting, 9-inch vertical holes are sunk with Bucyrus-

MINING WORLD

Erie 42T churn drills. Bits used are of nickel alloy steel, SAE 4340 or the Norwegian SNC 15. In ore, about 15 feet of hole per shift is average. It is somewhat more in waste (about 22).

Drilling totalled 71,200 feet in 1952. Bits averaged 5.4 feet in ore and 9.0 feet in waste with each sharpening. Table No. I shows footage and total drilling time as compared to down time for the first three months of 1953.

One of the most annoying of the drilling difficulties is that of having to drill through faults and rock layers of varying hardness crossed by the hole at a small angle. The bit tends to slip down the hard surface and cause a bend in the hole. Two or three small pieces of scrap sheet iron are dropped into the "low" side of the hole and one side of the drill bit bangs away on them while the hard layer is broken through. This wasted time is not considered down time for the purpose of the record.

There are 10 of the 42T drills of which an average of seven are in operation. They normally work in groups along the top of the bench. Each has one drill operator, but helpers vary from one per rig to two for three rigs or one for two rigs.

Bits are maintained at a central shop on two Bucyrus-Erie Model 12BD bit dressing machines. After forging, bits are cooled and reheated to 830° C. in a salt bath furnace and tempered with a water quench. About 45 bits per day are used.

### Ore Breaks Badly

By European standards, powder consumption is high. In the United States it would not be considered

Lowering 22-pound packages of dynamite into churn drill holes. Note the double strands of Primacord which are knotted into first package lowered into hole.



OCTOBER, 1953



Included in the fleet of haulage units are 12 of these 35-ton Tournarockers. They are powered by 245-horsepower Buda Diesel engines, and are loaded by Bucyrus-Erie 120-B, four and one-half yard electric shovels.

excessive. Powder factor is 110 to 120 grams per ton (about 0.25 pounds) for primary breaking and 9 grams per ton of ore or 13 grams per ton of waste for secondary breaking. However, to attain this figure, all blasting factors are closely controlled with the assistant mine superintendent calculating the exact loading for each hole.

Normal practice is single row blasting. Holes are bottomed 6 to 8 feet below grade with a burden ranging from 20 to 27 feet at the toe and spaced at 18 to 25 feet depending on conditions. Rock breaking characteristics vary somewhat in different parts of the pit, but the horizontal area blasted per hole ranges between 385 and 485 square feet. All ground breaks in slabs.

Holes are loaded with a toe charge and two deck charges. Each contains about  $\frac{1}{3}$  dynamite and  $\frac{2}{3}$  ammonium nitrate powder. An average hole charge might be five to eight boxes, containing 66 pounds each, in the bottom load and 110 and 90 (50 and 40 kilograms) in the two deck loads. The first deck load is placed 35 feet below the collar of the hole and the second about 20 feet below. Sand stemming is used between the loads and to the top of the hole.

The dynamite, in cartridges of 22

pounds, is lowered by a rope, while the ammonium nitrate powder cartridges, also weighing 22 pounds each, are slit with a knife and the loose powder poured into the hole. Detonation is by a double strand of Primacord affixed by a knot to the first cartridge of dynamite lowered into each hole. Two detonating fuses for each hole are coupled in parallel.

Millisecond delay blasting was introduced in the summer of 1952. Practice is to shoot the hole with the lightest burden first, and to fire successively the holes in either direction with a 25-millisecond delay between each pair of holes. It is believed that better fragmentation and reduced powder consumption has resulted from this change from the former instantaneous blasting.

Due to structural characteristics, breaking faces at right angles to the strike gives by far the best results. Thus it is often necessary to shoot very narrow faces, and multiple row blasting has been considered. Promising experiments in this direction will be carried further.

### Experiment with Skull Cracker

Secondary breaking has, so far, been done by block holing. Units of one Ingersoll-Rand, 315-cubic-foot-





This white building at the north end of the north pit houses the primary crusher. Ore from all pits is hauled by truck to this point, crushed to minus-5-inches and delivered by rail to the mill.



For cleaning up spill around the shovel and other pit chores in which speed of movement between jobs is important, two of these rubber tired Tournatractors are used.

A skull cracker at work breaking off shattered fragments from a face. A Bucyrus-Erie 54B drag line with 60-foot boom swings a seven ton forged steel block.



Table No. 1  
Footage Drilled, Drilling Time, and Distribution of Delay Time at Sydvaranger During First Three Months of 1953

MATERIAL DRILLED			
Ore		10,253 Feet	
Waste		12,047	
Total		22,300 Feet	
TIME			
Drilling	8,652 Hours	80.7 Percent	
Delay	2,068	19.3	
Total	10,720 Hours	100.0 Percent	
TIME DISTRIBUTION			
Lunch time	445 Hours	21.5 Percent	
Stuck tools	1,038	50.2	
Other	585	28.3	
Total	2,068 Hours	100.0 Percent	

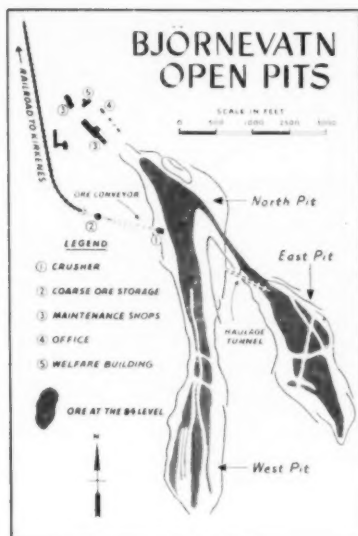
per-minute compressor, and three or four Thor 45-pound jack hammers with tungsten carbide-tipped steel are used. On an average, 1,000 tons of broken ore will require about 25 block holes. It is felt that this number can be reduced by better primary breaking, but there seems to be no way of eliminating the problem.

In an effort to reduce cost, experiments with a skull cracker, or drop ball, have been started. A Bucyrus-Erie 54-B (2½-yard) dragline with

Blast holes in the very hard taconite are put down with Bucyrus-Erie 42T churn drills using 9-inch, nickel alloy steel bits. Each bit will average 5.4 feet in ore and about 9.0 feet in waste per sharpening.







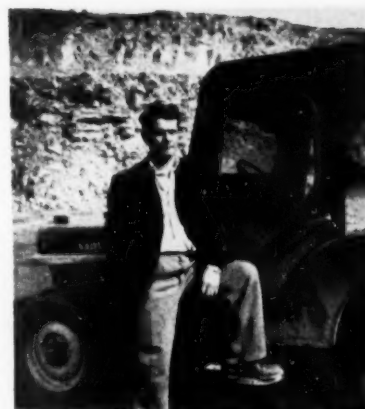
a 60-foot boom has been equipped with a 7-ton forged steel cube that seems to work well. The cube is attached to a one-inch preformed wire rope through a swivel and a worn out truck tire that acts as a shock absorber. Three out of four fragments will break the first time they are hit with a full drop of the ball. The cube also can be swung against a face to break down partially loosened fragments.

The principal hazard in this system is from flying fragments of rock or steel broken from the ball. Workmen are kept out of the immediate area of the skull cracker, and the operator is protected by two thick layers of shatter-proof glass around his cab. No accidents have occurred. The crawler-mounted unit moves slowly between working places. With Sydvaranger's multiple pit mining, it could mean separate units for each pit with each of them idle a considerable part of the time.

#### Large U. S. Trucks and Shovels

Broken ore and rock is loaded with four Bucyrus-Erie 120-B electric shovels. The 4½-yard size was selected because any ore that will pass through the dipper will enter the opening of the 54-inch primary crusher. Two or three shovels are needed. Each will load 1,800 to 2,000 tons of ore per eight hour shift. Performance has been good and costs reasonable. During 1952, hoist rope life on the shovels averaged 95,065 tons; 10,530 tons were loaded per each dipper tooth.

Hauling from pit to crusher (which is adjacent to the north pit) and of waste to the dumps is with a fleet of 12 Tournarockers of 35 tons capacity and eight Euclids of 22 tons



Ottar Brekke, assistant mine superintendent.

capacity of which altogether 10 to 12 currently are in use. The trucks are equipped with 275-horsepower Buda Diesel engines and the Tournarockers with 240-horsepower Buda Diesels. Currently, the Tournarockers are being used in the north pit while the faster Euclids are hauling from the more distant east pit.

The hard, abrasive material causes excessive truck body wear. Some bodies have been lined with Jones and Laughlin's Jalloxy plate which gives considerably longer wear than carbon steel. This experiment, however, is too new to have definite cost figures available.

#### SYDVARANGER PRIMARY CRUSHING

### Specially Designed 54-Inch U. S.-Built Gyratory Reduces Tough Abrasive Ore To 6-inch Size

Primary reduction of the ore to about six inches is accomplished in a 54-inch Nordberg gyratory crusher—the first of its type built. The design of the unit resulted from close cooperation between the engineers of Nordberg Manufacturing Company and Sydvaranger. With the experience gained from the operation of the two old Allis-Chalmers 36-inch gyratory crushers, it was anticipated that crushing of this hard ore would set up stresses not developed in other crushing. Therefore, an oversize main shaft (50 inches in diameter) below the headcenter and a heavy construction for the five shell rings were used. The crusher weighs approximately 1,000,000 pounds.

In designing the lubrication system for the crusher, the plan has

been for the oil to serve as a lubricant and also as a coolant in removing heat from the bearings and gears resulting from the energy generated as ore is crushed.

The crusher has four separate oil inlets and about 100 gallons of oil per minute are delivered at a controlled temperature and rate by a Viking pump, which circulates about 100 gallons per minute. The system contains about 1,000 gallons of oil, and Texaco Meropa No. 2 is used.

During most of the year, cooling of the oil is necessary. Oil from two outlets in the crusher flows to a tank, from which it is pumped, still warm, through four U. S. Hoffman oil filters and four Ross coolers, back to the crusher. The water for the Ross coolers is cooled in heat exchangers.

Flow, temperature, and pressure control devices are connected to indicators located on a panel behind the crusher operator. In case of malfunction at any point, a horn blows, the operator turns, checks his panel, and, if he does not have to stop the crusher, makes the necessary adjustments manually.

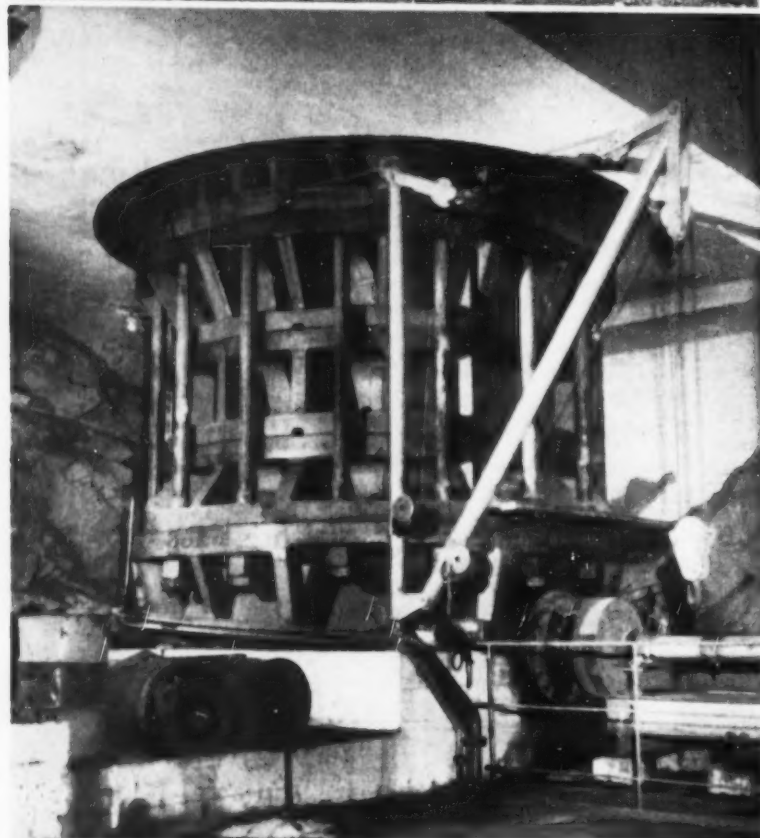
The lubrication system has worked very well; oil consumption has been moderate. The same lubrication and control systems have been incorporated in some 60-inch gyratory crushers recently installed in the United States.

In the winter it has been found advisable to keep the crusher heated during shutdowns. It is not necessary to cool the oil in the wintertime during periods of low temperatures.

A 600-horsepower induction motor drives the crusher. Momentary peaks up to 1,500 horsepower occur. The motor is connected to the crusher through an extension shaft



TOP: A big, 22T Euclid truck dumps ore directly into the top of a 56-inch primary crusher. BOTTOM: "Anders," the big primary crusher at Sydvaranger. This 56-inch Nordberg gyratory weighs approximately 1,200,000 pounds and is driven by a 600 horsepower Westinghouse induction motor.



with two specially designed flexible couplings.

During the first months of operation the motor was occasionally stalled by large ore boulders in the crusher; however, the gears were undamaged. Stalling of the motor seldom happens now.

In any case, excepting for some difficulties during the start of operation, the primary crusher's performance has been almost trouble-free and very satisfactory. The first, lower mantle crushed 1,800,000 tons of ore, and the upper mantle is expected to crush even more. The concave liners were removed after 1,250,000 tons had been crushed in order to narrow the opening by filling behind the miners.

The crusher spider is protected by a heavy beam construction, which channels the ore to the two sides of the crushing chamber.

The crusher discharges to a 100-ton surge bin; a 60-inch Ross Chain Feeder uniformly controls the ore flow to a 42-inch belt conveyor with a Goodrich, 8-ply No. 100, rubber belt. The conveyor is 830 feet in length, and the ore is elevated about 210 feet. Ore is weighed by a Merrick Weightometer and discharged into a 10,000 ton storage bin. From this bin, the ore is hauled on a six-mile-long, normal gauge, electric railway to Kirkenes.

#### **Good Maintenance Facilities**

The mine has a complete engine overhaul, tire repair, and maintenance shop. Large mine equipment, including shovels, tractors, and truck bodies are repaired with ease. Complete retreading of the large truck tires is done in the tire shop.

Facilities for the maintenance of the railroad rolling stock are located at the millsite at Kirkenes.

Although the big Firestone and Goodyear tires have an average life of 4,000 hours, tire costs are an item of considerable concern (tires are expensive in this remote area). As a result, special attention is given to roads, maintenances, and they are kept in top condition. A Caterpillar No. 12 road grader operates 24 hours a day most of the year.

A pair of rubber-tired Tourn-

**MINING WORLD**

tractors with 180-horsepower Buda Diesel engines clean up around the shovels and perform general house-keeping chores. Three Caterpillar D8s are partly used for the same work and for heavy roadbuilding and related tasks. They are also used for grading and cleaning up the waste dumps.

The heavy mine-service trucks are three, five-ton Four Wheel Drive units with Waukesha gasoline engines. Mine personnel are transported in Willys jeeps which have special Sydvaranger-built aluminum bodies to give protection during the long, cold winter.

During the short period of the midnight sun, lighting of course, is no problem. However, during the long winter of almost total darkness, the entire pit area is lighted by strings of floodlights. Interestingly enough, productivity does not seem to decline materially during the winter, and there is little to indicate that cold weather has caused

excessive breakage of exposed steel parts.

#### Ore Railed to Mill

From the 10,000-ton bin at the mine's primary crushing plant, the crushed ore goes through two swinging chutes into 40-ton bottom dump railroad cars. Each chute is regulated through a compressed-air-activated counterweight. Thirteen to 14 cars are filled in 10 to 15 minutes, and are loaded continuously as the cars are passed slowly under the chutes.

Strings of 13 to 14 cars, i.e., about 500 tons of ore are hauled to the mill at Kirkenes, a distance of about 5.5 miles. At the present seven trains per shift are necessary, as permissible speed on the railway is limited to about 20 miles per hour. Forty cars, which were repaired after the war, are available.

The cars are dumped in the mill bins at Kirkenes. Some freezing in the cars takes place during the win-



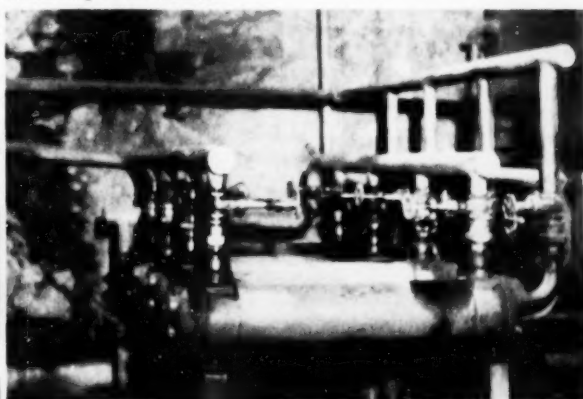
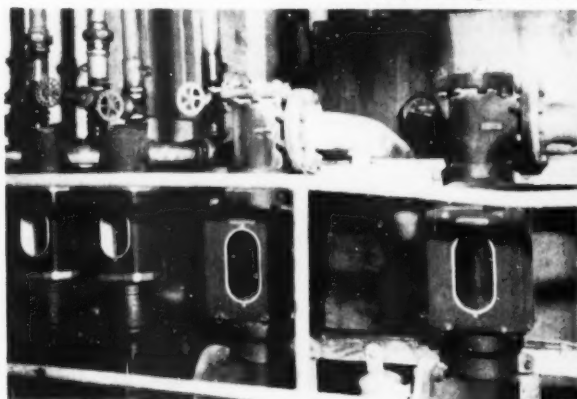
ter and car shake outs will be installed.

For haulage one 65-ton and two 50-ton direct-current electric trolley locomotives are in use; for switching, four 20-ton trolley locomotives are in use.

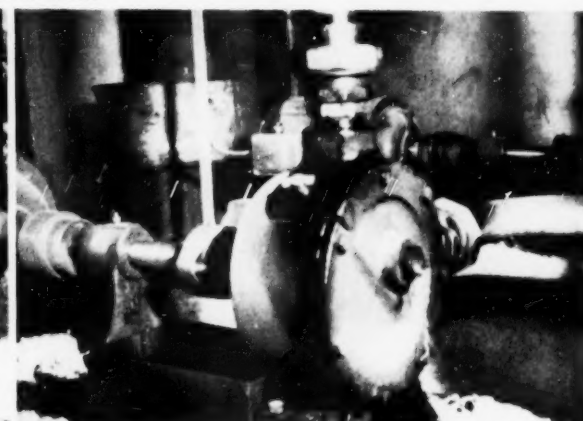
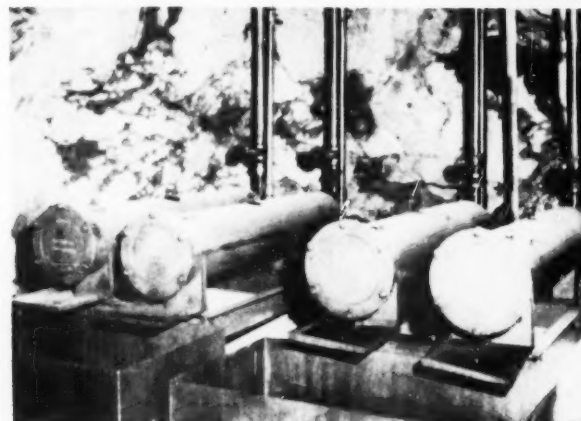
All of these locomotives are old and were repaired after the war. Two new Diesel-electric locomotives will be procured to replace the old ones.

For all rail transportation, several old steam locomotives are available. They will be replaced by two Diesel locomotives, which will also serve for transportation of concentrate from the storage buildings to the dock.

**LEFT:** An elaborate lubrication and cooling system is a vital part of the primary crusher. These Fisher and Porter flow meters and gauges control flow and temperature of oil which is independently circulated to each bearing. **RIGHT:** After filtering, oil is cooled in this bank of four Ross heat exchangers before recirculating to the crusher.



**LEFT:** Oil from the primary crusher bearing is stored in a tank, then filtered in these four U. S. Hoffman oil filters. **RIGHT:** The cooled and filtered oil is delivered, under pressure, to the primary crusher bearing by two of these Viking pumps. Pumps are powered by 2-horsepower General Electric motors.





An overall view of the mill at Kirkenes. The entire building and all of the conveyor galleries are built of reinforced concrete.

An interesting view of a transfer point on an ore conveyor gallery. The conveyor galleries present a rather spectacular appearance because they are built entirely of reinforced concrete.



## SYDVARANGER MILLING

# Circuit Features Concentrate Regrind Before Two-Stage Magnetic Cleaning

By **MARCUS DIGRE**  
Mill Superintendent

Metallurgical practice in the new mill follows quite closely the basic flowsheet developed during the original operation. At that point, however, similarity between the two plants ends. The old mill had literally acres of small machines whirring along. The new has two, simple, identical circuits made up of some of the largest and most modern equipment available.

The basic flowsheet is simple. Ore is subjected to two stages of fine crushing and ground in a ball mill operating in closed circuit with a duplex spiral classifier. The classifier overflow is treated by magnetic separation to produce a rougher concentrate. Tailing flows to waste.



**MARCUS DIGRE**

Marcus Digre is a typical young Norwegian taconist. Supplementing his engineering degree have been trips to mines and mills in the Scandinavian countries, as well as to major mining operations abroad.

Concentrate from the primary magnetic separators is reground in another ball mill, and the discharge is again treated by magnetic separation. Tailing goes to waste while the concentrate is filtered, dried and shipped without agglomeration of any kind.

The accompanying plan drawing shows the arrangement and the equipment in the mill. A study of the equipment, its performance, and some of the reasons behind its selection it is hoped will be of interest to millmen in general and taconists particularly.

The fine crushing plant has two independent and identical circuits. Each consists of a No. 7 (60-inch) Ross chain feeder delivering ore from a 3,000-ton coarse ore storage bin to a seven-foot Symons standard cone crusher. The crusher discharge splits to two 5- by 8-foot Symons rod deck screens with  $\frac{3}{8}$ -inch openings, and the screen oversize goes to a pair of seven-foot Symons shorthead cone crushers. The shortheads are not in closed circuit with screens. Each crusher is of the heavy-duty type.

The screen undersize joins the discharge of both shortheads on a 42-inch conveyor belt, and, by two more conveyors, it is elevated 160 feet to a 10,000-ton storage bin. The horizontal shuttle belt across the top of the bin is equipped with a continuously traveling conveyor for

distributing and blending the ore in the bin.

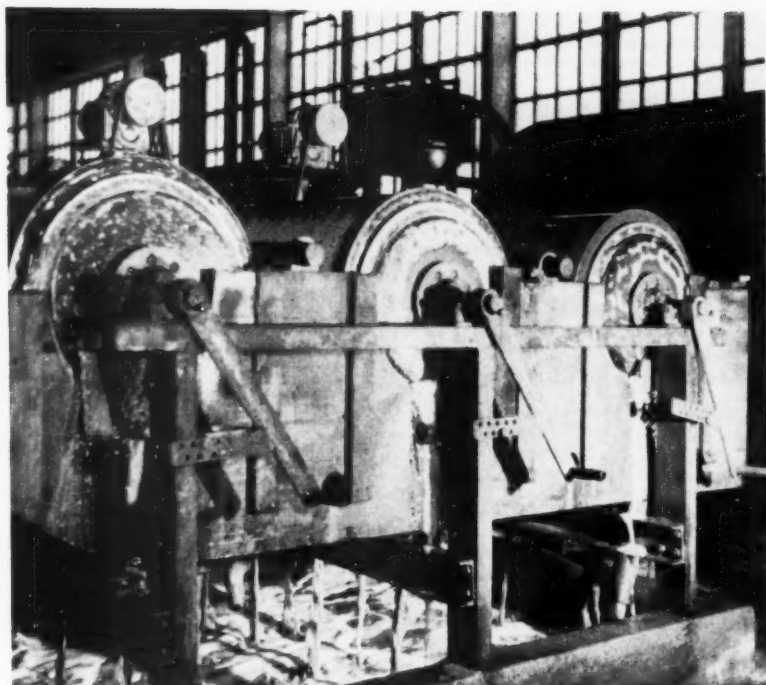
Dust protection at this point is unusual and quite effective. The tripper discharges ore through a pair of parallel slits, one on either side of the belt. These slits are covered with strips of conveyor belting that act as dust seals. They are fastened at either end of the bin; at the tripper, they are carried up and over the discharge spout by a system of idlers to provide a minimum-sized opening through which the ore drops into the bin. An exhaust fan maintains a slight vacuum in the bin and the dusty air is drawn through a wet scrubber.

Crushing is controlled from a room above the standard cones. Here are located the meters, signal lights, and stop buttons for all major machines. Also at this point is a Rate-O-Graph, coupled with a Merrick Weightometer, showing tonnage being handled.

Each crusher has its own oil system complete with pump, filter, and coolers. Temperature and pressure checking is automatic. Conveyors, crushers, screens, and feeders are interlocked in sequence.

All machines are equipped with dust hoods, and hoods and conveyors are completely sealed. Suction fans remove the dusty air at several points. It is filtered in a bag house and cleaned air exhausted to the atmosphere. Clean air is used to cool





Concentration of all ore is handled in eighteen of these magnetic separators. All have alnico permanent magnets, are driven by one hp motor and have the water sprays above the drums. The first drum makes a rough concentrate which is cleaned on the second drum and re-cleaned on the third. The machines were designed by Worm Lund, chief engineer at Sydvaranger, and built by A/S Thune in Oslo.

the bearing seals and the fan-cooled motors.

A 100-ton traveling crane and a 10-ton auxiliary hoist are used for expediting repairs. Units to be repaired are lifted and moved to a repair bay outside of the crushing plant proper.

#### Have Some Problems

During the first year of operation there have been problems with fine ore freezing in the bins and too

coarse a feed to the standard crushers. These troubles seem to be in direct proportion to the setting of the primary crusher. A fine setting there gives satisfactory operation in the fine crushing plant even in the winter. A coarse setting produces excessively slabby material. This, in turn, results in uneven crushing; in the winter time the fines build up in the bin, freeze together, and choke the intake to the feeders.

Most of the year, dust control has

been satisfactory, but in extremely cold weather the present installation is inadequate. A large pipeline is being installed to by-pass the bag house and to lead directly to the scrubbers in the mill. This will increase the suction at the collection points and, together with some other modifications it is hoped, give better dust removal.

#### No Rod Mills

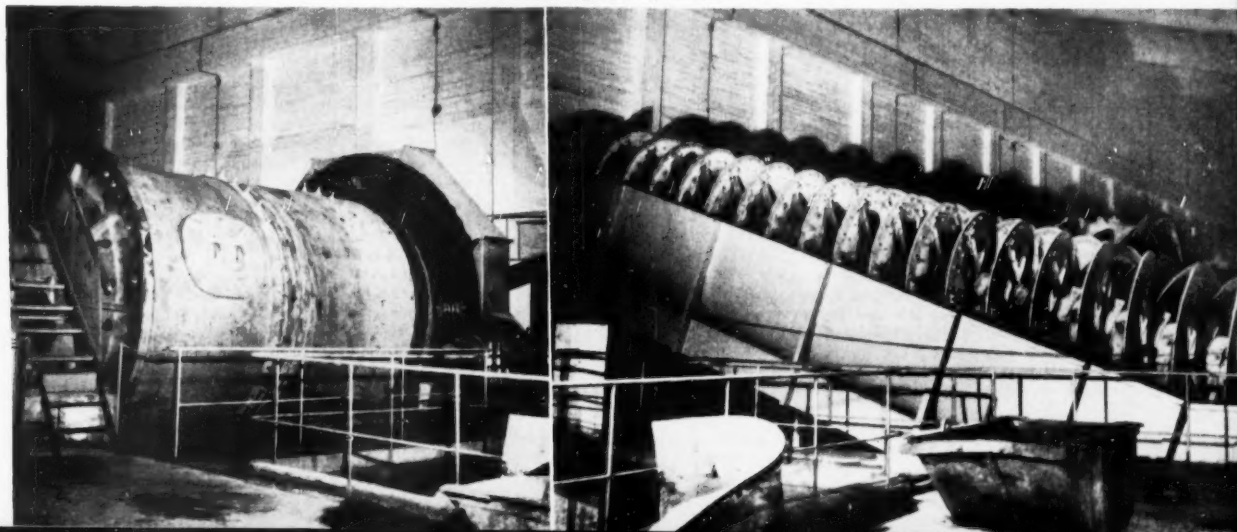
Grinding and concentration is accomplished in two identical circuits. A row of 24 Hardinge Constant Weight feeders along the 400 feet of fine ore bin withdraw fine ore, at a controlled rate, to conveyors feeding each primary ball mill. A Merrick Weightometer records the input to each primary ball mill.

Different from much of the experimental work in the United States and contrary to much present day grinding practice, no rod mills are employed. It is felt that reducing to finer sizes in cone crushers and feeding directly to ball mills is the most economical means of obtaining the desired grind.

Primary grinding is accomplished in a Nordberg 8-foot 10-inch by 17-foot grate discharge ball mill. It has manganese steel end liners and high-carbon steel rail liners along the drum. It is charged with about 75 tons of balls, and five-inch balls are added for make-up. It is planned to try using four-inch balls, provided finer feed is sent to the primary ball mills. This is expected to give better grinding and less liner wear. The ball mill speed is 18.9 revolutions per minute.

The mill operates in closed circuit with a 78-inch Akins Duplex Spiral, double-pitch, high weir classifier (manufactured by Head-Wrightson in England) which overflows to a

LEFT: Both primary and secondary grinding are accomplished in these big, Nordberg, eight foot ten inch by seventeen foot ball mills. RIGHT: A primary grinding mill operates in closed circuit with these seventy-eight inch Akins Duplex Classifiers. Classifier overflow is treated in a bank of five magnetic separators.



**Table No. II**  
**Metallurgical Data and Screen Analysis, June 1953<sup>1</sup>**

Product	Iron assay			+1- inch	+1/2- inch	+3/4- inch	+6- Mesh	+10- Mesh	+20- Mesh	+35- Mesh	+65- Mesh	+150- Mesh	+200- Mesh	+325- Mesh	Total Through +325- Mesh
	Total Percent <sup>2</sup>	Magnetic Percent <sup>3</sup>	Percent Solids												
Primary mill feed	34.1	30.8	99	4.5	37.5	65.5		79.0		86.0		91.0		95.5	100.0
Primary mill discharge	37	34	78			3	7	15	27	40	55	75	80	85	100.0
Classifier sands	40	37	90			5	10	20	40	55	70	85	90	94	100.0
Classifier overflow	34.1	30.8	50						0.4	4.7	15.6	37.2	48.5	64.6	100.0
Coarse concentrate	54.4		67												
Sec. mill discharge	54.4		67												
Final concentrate	64.7		64												
Coarse tailings	6.7	1.5	15								0.9	9.8	19.0	42.2	100.0
Fine tailings	6.7	1.55	5												

<sup>1</sup> 2.12 tons of crude ore per ton of concentrate.

<sup>2</sup> 89.7 percent extraction of total iron content.

<sup>3</sup> 97.4 percent of magnetic iron.

pulp distributor ahead of magnetic separation.

The classifier tank is about six feet longer than standard to enable it to lift the sand high enough to discharge it directly to the scoop box of the mill. Hence, the spiral assemblies are the heaviest built in England to date. The special hollow shafts are 22½ inches in diameter, lap-welded longitudinally, and butt welded with cover straps at about the center. Skefko bearings are used throughout, and the one at the upper end of the shaft is suitable for taking both the radial load and the thrust from the spiral.

Classifier overflow, about 5.0 percent on a 35-mesh screen and about 35 percent through a 325-mesh screen, is split to five, three-drum magnetic separators. The first drum of each machine produces a first concentrate which is cleaned on the second drum and recleaned on the third. The concentrate then goes to a regrind circuit and the tailing flows into Vranger Fjord as waste.

The grinding-classification operations are controlled from a central panel, equipped with feed rate controllers, Rate-O-Graphs, flowraters for water addition, recording kilowatt meters for ball mills and classifiers, starting buttons for the mills, and signal lights for the main machines in each circuit.

### Separator Design Different

The magnetic separators were designed by Worm Lund, Sydvaranger's chief engineer, and built by A/S Thune in Oslo. They differ considerably from any magnetic drums built in the United States, and Sydvaranger management feels they do a better job than any other type. Mill records show a 97 to 98 percent recovery of magnetic iron which speaks well for the machine's performance.

The machines are of a permanent magnet type with each drum having three alnico magnets with a strength of 350 gauss measured at two inches from the drum. In the old plant, separators with electro-magnets were used. There it was found that it was not possible to control the grade of concentrate by varying the strength of the magnets, and that as long as the magnets were strong enough to do the job, their intensity might as well be fixed.

Several advantages accrue from using the permanent magnetic drum type of separator. First, the initial cost is lower because transformers, rectifiers, wiring, etc., which make up about one-third of the cost of some machines, are eliminated. Also, no cooling is needed. Maintenance is reduced because no electricians are required; down time is cut

and the drums are completely watertight. Three years of continuous testing use revealed no loss of magnetic strength.

Another point of difference on the Sydvaranger machine is that there are no water sprays in the box. It was found in the old plant that it was extremely difficult to keep the tiny jets open. The new units are designed so that the only sprays are those between the drums which supply water ahead of each separating step.

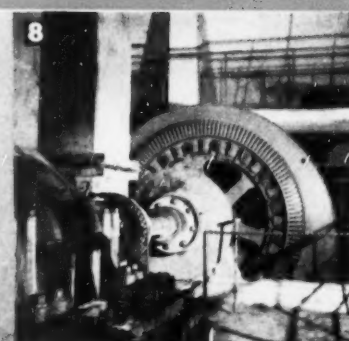
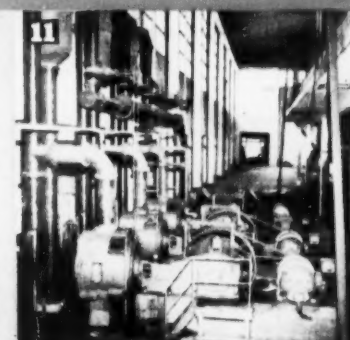
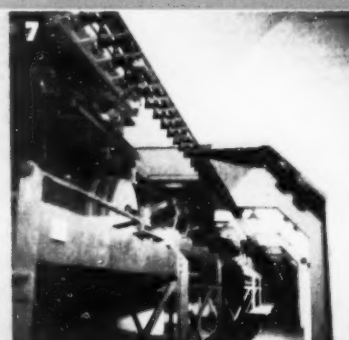
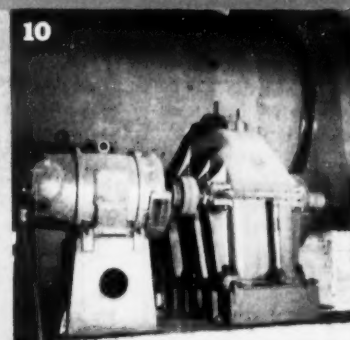
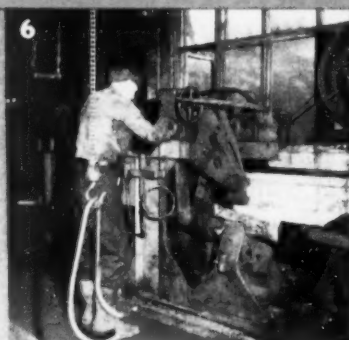
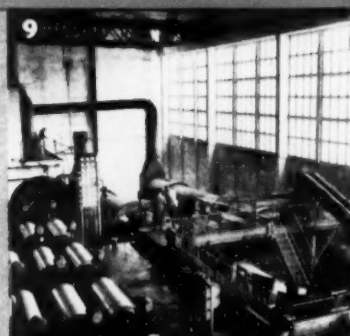
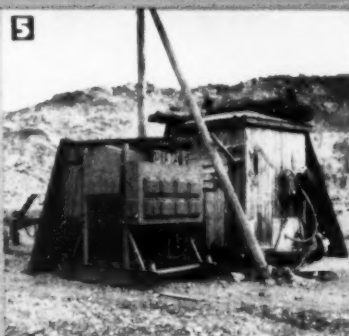
Each of the three drums is driven, in the direction of ore flow, by a 1-horsepower motor, but only 0.5-horsepower is drawn. Feed is held at 40 to 45 percent solids, and the concentrate comes off at 65 percent solids. Feed to the first drum is diluted to the proper consistency in the launder from the classifier overflow; that to the second and third drums by the sprays mentioned above.

All Norwegian magnetite mills and some in Sweden are now using this type of separator.

The rougher concentrate from primary magnetic separators is reground in a second Nordberg, 10-foot 8-inch by 17-foot overflow-type ball mill in open circuit. This mill is charged with Sil Pebs instead of balls. Quite frankly, management is not satisfied with the present sec-

(1) All diamond drill prospecting is done with a Longyear Straightline Junior gasoline-powered machine. EX diamond core bits are used, and the very hard and abrasive ground makes bit wear extremely rapid. (2) Blast holes in the very hard taconite are put down with Bucyrus-Erie 42T churn drills using 9-inch, nickel alloy steel bits. Each bit will drill 5.4 feet in ore and about 9.0-feet in waste per sharpening. (3) A Bucyrus-Erie 120-B, electric shovel loads broken ore into a 22-ton Euclid. The truck is powered by a 275-horsepower Buda Diesel engine. Bucyrus-Erie 42T churn drills can be seen working on the bench above. (4) A Tournarocker dumps a 35-ton load of taconite ore into the 56-inch Nordberg primary gyratory crusher. (5) Power in the pit is stepped down from line voltage by portable transformer stations. The new type of station on left is replacing the older model at right. (6) Churn drill bits are resharpened on this Bucyrus-Erie model 12 bit dressing machine. (7) Looking through the corridor below the 10,000-ton fine ore bin. In the upper left can be seen one of the 24 Hardinge constant weight feeders which deliver ore to the belt that feeds the grinding section. (8) This 1,200-horsepower Electric Machinery Manufacturing synchronous motor drives the big ball mill through a magnetic clutch. Because of the extremely high starting load, the motor is permitted to build up speed and the clutch is engaged gradually with the minimum of shock. (9) About half of all concentrates produced is dried to 4.0 percent water in these two Ruggles-Cole driers. This dried concentrate is blended with the concentrate, which comes from the filters at about 9.0 percent water, to produce an acceptable shipping product averaging 5.5 to 6.0 percent water. (10) The two big Ruggles-Cole driers are driven through Falk reducing gears. (11) This bank of three Worthington, type HBV, 31- by 13-inch dry vacuum pumps maintained the suction on the five 8- by 16-foot Oliver drum concentrate filters. (12) Coal from Spitzbergen and heavy equipment are unloaded at this quay. All heavy equipment is unloaded by the heavy-duty crane in the foreground. The coal ship at the dock is being unloaded by a clam shell bucket which travels on the horizontal bridge in the background.

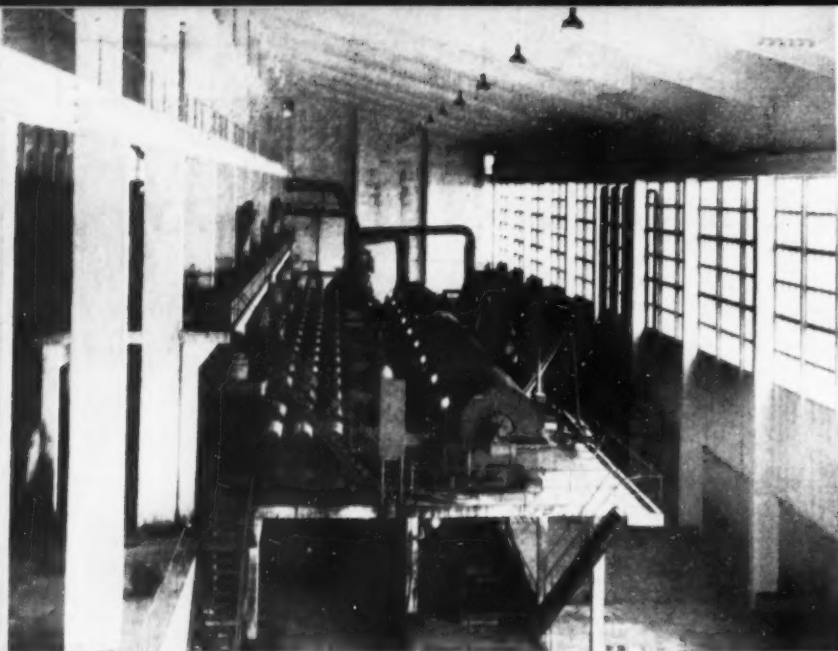
# MINING WORLD'S CAMERA LOOKS AT NORWAY



OCTOBER, 1953

[World Mining Section-55]





Looking down on the magnetic separation and filtering floor of the mill one sees (left) 18, 3-drum magnetic separators of Sydvaranger design, and five 8 by 16 foot Oliver drum filters.

ondary grinding practice. One new grinding circuit is being installed to give additional capacity, and several experiments, including some with cyclones, are being conducted with a view to improving this part of the process. Tests with closed circuit grinding with mechanical classifiers did not indicate this would aid materially.

### Two Types of Filters

To meet present Norwegian ship-ping specifications, concentrate must

carry between 5.5 and 7.0 percent water. If the concentrate is drier, or wetter, the specifications require transversal and longitudinal bulk-heads in the ship's holds. Therefore, filtering and drying are important steps in the flowsheet.

Briefly, filtering is accomplished on five 8- by 16-foot Oliver panel-type drum filters. Half of the concentrate passes to oil-fired Ruggles-Cole driers where water content is reduced to between four and five percent. Dried concentrate is blended with concentrate coming

directly from the filters to make an acceptable product.

The details of the filtering operation are quite interesting. All machines are of the standard, blower type. Vacuum at 20 to 24 inches is maintained by three type HBV, 31-by 13-inch Worthington vacuum pumps. Two of them are normally in operation. Three of the filters are operated in the orthodox manner with the cake being broken off by air pressure, while the other two have been slightly revamped so that the cake is removed by a scraper during normal operation.

The blower-type machines have National Filter Media, style N 1000, nylon filter cloth. With a new cloth, capacity is about 50 tons per hour and water content can be reduced to 10 percent. Capacity drops rapidly as the cloth begins to blind, and averages about 30 tons per hour, while the water content is also reduced to about 7.5 percent. After three weeks, the capacity is down to 20 tons per hour and water to less than seven percent. Then, the cloth must be washed and replaced before capacity drops this low; three to five uses are expected from each cloth.

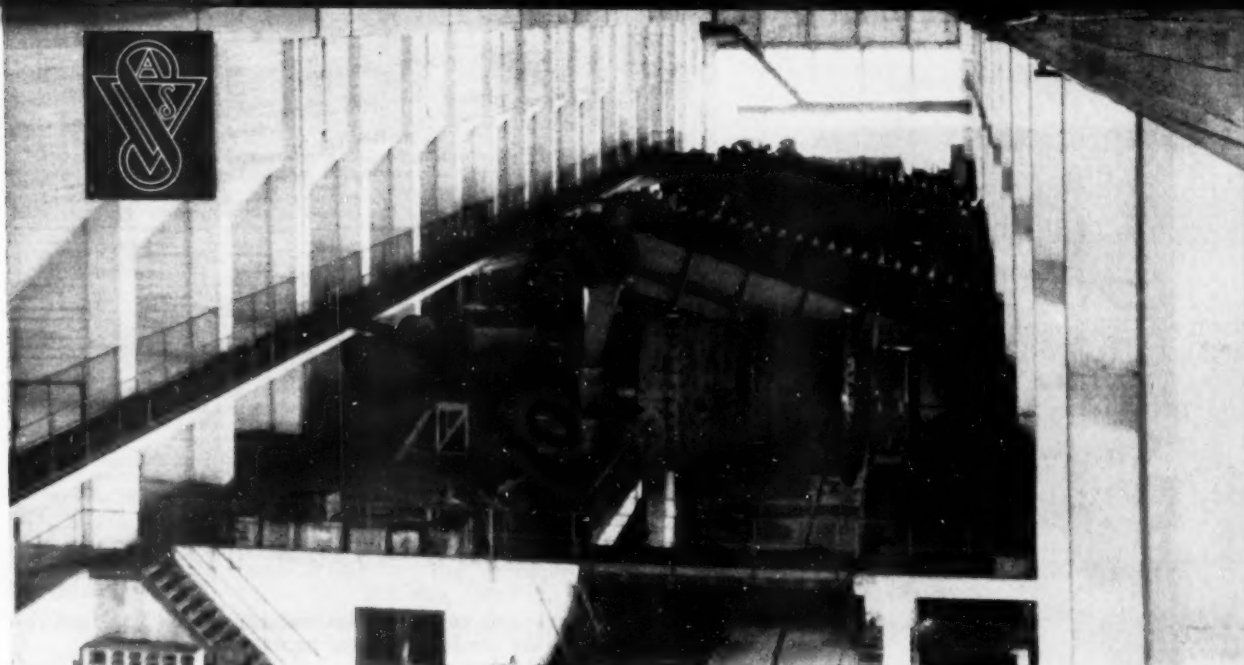
With the scraper-type machine Lainyl filter cloth from the Belgian firm, S.A. Lainiere de Sclessin, and a nylon filter cloth manufactured by Porritts and Spencer in England are used because each has a rough surface and the nap seems to hold the cake well. Regular nylon cloth and bronze screen proved too smooth. Between  $\frac{1}{2}$  and  $\frac{3}{4}$  inches of clearance is left between the cloth and



LEFT: VacSeal pumps similar to the one shown here are used for pumping all pulps in the concentration circuit. Pumps were supplied by International Combustion Limited of London. BELOW: Concentrate is spouted directly into ship holds at the loading quay on the bank of Varanger fjord.







Looking down on the grinding floor. There are two identical circuits consisting of an 8-foot 10-inch by 17-foot Nordberg primary ball mill in closed circuit with an Akins 78-inch duplex spiral classifier and one identical size regrind mill which is charged with Silpebs instead of balls.

the scraper. The drum is permanently covered with a filter cake of this thickness which acts as the filter medium proper. This filter bed also blinds and every two to three hours it is blown off. A new filter bed of the desired thickness is formed in a few minutes.

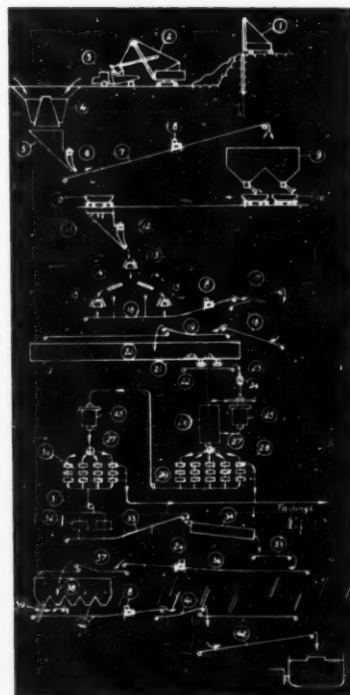
Operation of the scraper-type machine is far more regular. When the cloth is new, the capacity is about 60 tons per hour and the water content reduced to nine percent. After one week, this drops to about 40 tons per hour and eight percent water. It remains fairly constant at this point for a month or more. Filter cloths can probably be washed and reused about 10 times.

Obviously, concentrate from these machines requires more drying, but it is believed that the saving in filter cloth, power for the vacuum pumps, and maintenance offset the added cost of drying. In addition, capacity is 30 to 40 percent higher and down-time considerably less than for filtering with blow discharge. The remaining blower filters will, in time, be changed to scraper filters.

The Ruggles-Cole Dryers, built in England by Head Wrightson, are 104 inches by 70 feet and are of conventional design. Heavy chains were provided at the feed end to prevent the sticky concentrate from building up inside the drum but they have now been removed.

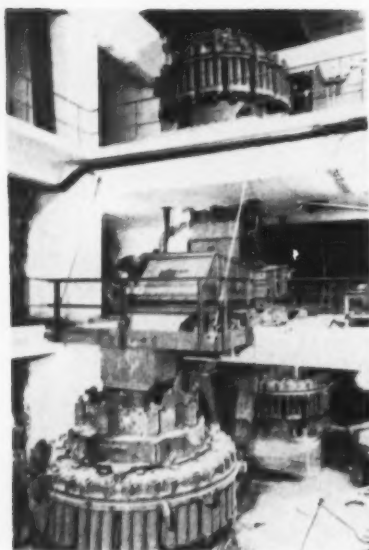
Each dryer has a combustion chamber provided with four No. 4 Rotovac type W. patent oil burners, fitted with oil and air controls. These burners are each mounted on a hand-

### Ore Flow Diagram Bjornevatn Open Pit Mine and Kirkenes Concentrator of A/S Sydvaranger



- Bjornevatn**
1. Churn drill, Bucyrus-Erie 42 T
  2. Electric Shovels, Bucyrus-Erie 120-B, 1½ yard dippers
  3. Haulage, 40-ton Tournarockers and 22-ton Euclids
  4. Gyratory crusher, 54-inch Nordberg
  5. 100 ton ore bin
  6. Ross chain feeder, 60-inch
  7. Conveyor belt, 42-inch by 910-feet
  8. Merrick Weightometer
  9. 10,000 ton crushed ore bin
  10. 40-ton bottom dump railroad cars

- Kirkenes**
11. 5,000 ton primary ore bin
  12. Ross 60-inch chain feeder (2 units in plant)
  13. Seven-foot standard Symons cone crusher (2)
  14. Symons Rod Deck screen with ¾ inch openings (2)
  15. Symons shorthread cone crushers. Set at ¾ inch (4)
  16. Conveyor belt, 42-inch by 600-feet
  17. Conveyor belt, 42-inch by 112-feet
  18. Conveyor belt, 42-inch by 250-feet
  19. Conveyor belt, 42-inch by 430-feet
  20. 10,000 ton fine ore storage bin
  21. Hardinge constant weight feeders (24)
  22. Conveyor belts, 42-inch
  23. Ball mill feed conveyors, 24-inch
  24. Merrick Weightometers (2)
  25. Nordberg ball mills 10-foot 8-inch by 17-feet. Two primary and two secondary
  26. Akins 78-inch Duplex Spiral classifiers (2)
  27. Pulp distributors (4)
  28. Magnetic separators, Sydvaranger design, Built by Thune. (30)
  29. Four-inch Vaseca pumps (2)
  30. Magnetic separators (24)
  31. Four-inch Vaseca pumps (2)
  32. Oliver drum filters 8 by 16 foot (5)
  33. Concentrate conveyor, 24-inch
  34. Ruggles-Cole dryer, 12.6 by 70 feet
  35. Conveyor belt, 42-inch by 100-feet
  36. Conveyor belt, 24-inch by 1,100-feet
  37. Conveyor belt, 24-inch (2)
  38. 10,000 ton concentrate storage bin
  39. Moveable apron feeder (2)
  40. Conveyor belt, 42-inch
  41. Shuttle conveyor belt, 42-inch
  42. Ship loading conveyor, 42-inch



Fine crushing is done by two 7-foot Symons crushers—each discharging to two 7-foot shortheads. Symons 5 by 8 foot rod deck screens between the crushers separates minus-0.39-inch (10 millimeter) ore from the standard crusher discharge ahead of the shortheads.

operated air director, designed to guide induced secondary air to the flame.

The oil supply line to each burner is fitted with a solenoid oil valve with hand lever. This valve is held open as long as the electric supply to it is maintained, but cuts off the oil if something goes wrong. For this purpose the solenoid is hooked up with the exhaust fan, the driving motor for the dryer, the primary air

**Table No. V**  
**Material Consumption in A/S Sydvaranger's Mill**

Wearing Part	Life In Hours	Tons Crude Ore Treated	Weight of Liners In Pounds	Pounds of Metal Consumed Per Ton of Ore Milled
<b>CRUSHERS</b>				
Standard crusher, mantle	1200	350,000	5,000	0.0143
Standard crusher, bowl liner	1000	300,000	6,600	0.0220
Shorthead crusher, mantle	1150	170,000	5,000	0.0294
Shorthead crusher, bowl liner	1150	170,000	5,600	0.0330
<b>PRIMARY BALL MILL</b>				
Feed end liners (Mn-steel)	1400	200,000	7,400	0.0370
Grates (Chro-Moly)	1500	200,000	5,600	0.0280
Shell liners (Rail steel)	4000	500,000	50,000	0.10
<b>SECONDARY BALL MILL</b>				
Feed end liners (Chro-Moly)	3000	400,000	7,400	0.0185
Discharge end liners	3500	450,000	7,400	0.01645
Shell liners (estimated)	8000	1,000,000	50,000	0.050

**NOTES:**

5-inch balls in primary mill: 0.65 kilograms per ton crude ore (1.3 pounds per short ton), 1½-inch by 1¼-inch Syl Pebs in secondary mill: 0.9 kilograms per ton crude ore. (1.8 pounds per short ton). Burner oil for dryers: 3.4 kilograms per ton dried concentrate (6.8 pounds per short ton) or 1.7 kilograms per ton total concentrate (3.4 pounds per short ton). Life of conveyor belting, pump liners, filter cloths, dryer liners not yet established.

fan, and a photoelectric cell energized by the flame in the combustion chamber. The hand lever enables the burner to be lighted from a cold state and the lever automatically cuts out as soon as the light from the flame energizes the photoelectric cell.

The air to each set of burners is provided by a single-stage, motor-driven fan, fitted with a 12½-horsepower motor. Oil is preheated.

The exhaust gasses are drawn through wet scrubbers by 20,000-cubic-foot-per-minute centrifugal fans driven by 55-horsepower motors. The effluents from the scrubbers go through water seals and are laundered to a settling basin where the concentrate dust is reclaimed.

Tables accompanying this section give full details on metallurgy, oper-

ation, material consumption, and related items of interest.

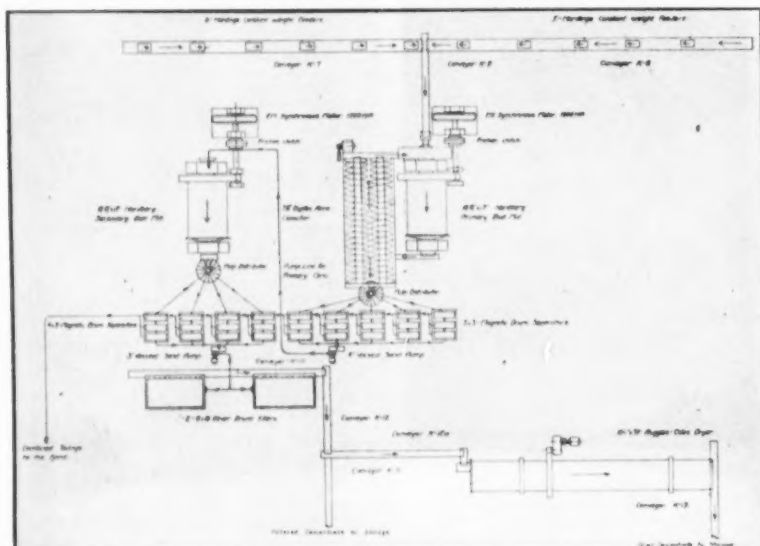
**All Concentrate for Export**

Alternate methods of handling the final concentrate are provided. After weighing, by a Merrick Weightometer, a system of conveyors can deliver concentrate to the old storage buildings or send it directly to the

**Table No. III**  
**Electrical Consumption in A/S Sydvaranger Mill During June 1953**

PROCESS	Unit Capacity Tons per net hour	Kilowatt-hours per ton crude ore
<b>CRUSHING</b>		
Standard crusher	375	0.29
Shorthead crushers	150	0.54
Feeders, screens, conveyors, etc.		0.64
Total		1.47
<b>GRINDING</b>		
Primary Grinding	156	5.63
Secondary Grinding	90	5.75
<b>SEPARATING</b>		
Coarse separators	31	
Fine separators	23	
Total		0.07
<b>PUMPING</b>		
Coarse concentrate pumps	90	0.12
Fine concentrate pumps	74	0.08
Total		0.20
Water pumping		1.07
<b>FILTERING AND DRYING</b>		
Filtering	36	0.45
Drying	52	0.30
Miscellaneous		0.30
Total Mill		15.24

**Equipment Layout for One Section of A/S Sydvaranger's Iron Ore Concentrator**



bin adjacent to the shipping quay. The old storage buildings provide some 100,000 tons of storage capacity. Concentrate is reclaimed from them by overhead cranes.

Since July of this year, normal procedure has been to carry the concentrate on two 24-inch conveyors a total distance of about 2,000 feet to a shuttle conveyor which discharges into a 50,000-ton concen-

**Table No. IV**  
**Operating Personnel for A/S**  
**Sydvaranger Mill During**  
**June 1953**

Process	Personnel
Crushing plant	1 shift boss
	2 feeder operators
	1 crusher operator
	1 conveyor operator
Separating plant	1 shift boss
	2 mill operators
	1 conveyor operator
	1 separator operator
	1 filter operator
	1 pump operator
	1 dryer operator
	1 repair man
	2 electricians

trate bin. The whole system is underground.

From the bin, the concentrate is

delivered by special belt feeders to 42-inch belt conveyors onto the traveling loading tower and then into the holds of the ships. With this system, loading is at a rate of 1,000 tons per hour. With the old system of reclamation from the storage buildings and haulage by rail to the dock, the loading capacity was about 400 tons per hour.

There is a 30-foot depth of water at the loading quay, so vessels up to at least 12,000 tons can be accommodated. Shipping distances to each of the three principal unloading points are about 1,600 nautical miles.

The concentrate is exported to West Germany, England, and Bel-

gium, with Germany taking about 80 percent of the production.

#### Pelletizing Plans

In order to provide a wider range of potential markets, and to ship a more valuable product, definite plans for the immediate erection of a pelletizing plant have been formulated. In connection with this, a 50,000 to 100,000-ton underground storage bin will probably be built to hold the pellets for shipment.



### SYDVARANGER MILL CONTROL

## Milling Circuit Features Close Control To Insure High Recovery and a Premium Concentrate

By ARNE STAVANG  
Research Engineer

In treating taconite, to make a high-grade concentrate and to maintain an excellent overall recovery, close control of the milling circuit is essential. The Sydvaranger plant was designed to weigh and sample at every necessary point; in fact, weighing and sampling are done at some points that would ordinarily be deemed unnecessary, but it is done to provide a double check on certain operations.

Merrick Weightometers straddle conveyor belts at strategic points. Ore is weighed on the belt between the primary crusher and the coarse ore storage bin. It is weighed again after fine crushing while en route to the fine ore storage bin. From this bin the ore is conveyed to two identical milling circuits and one Weightometer records the feed going to each primary ball mill. Rate-O-Graphs after primary crushing and ahead of ball milling make a permanent record of tonnage handled.

After milling, the concentrates from both circuits are combined, filtered, dried, and weighed en route to storage. Currently, another Weightometer is checking the weight of concentrate going into a new storage bin, and a final one shows

the tonnage drawn from this bin and loaded into ships at quay.

Eleven Geco (General Engineering Company) automatic samplers, plus hand sampling at three points, provide the checks for quality control. Hand samples are taken from the ball mill feed to get the screen analyses of the fine crusher product. The dried concentrate is hand-sampled and a water determination made. The final analysis of the shipping concentrate is, at present, made from another hand sample taken at the loading dock. Later, an automatic sampler will be used at this point.

Automatic samplers are installed in the circuit as follows: At each Akins classifier overflow (primary magnetic separator feed), at the secondary ball mill discharge (secondary separator feed), at the final concentrate, at the primary separator tailing, and at the secondary separator tailing. The combined tailings from the whole plant are also automatically sampled.

All samples are assayed for total iron and for magnetic iron. A screen analysis is also made of the classifier overflow and the final concentrate from each circuit.

The main minerals in the ore are



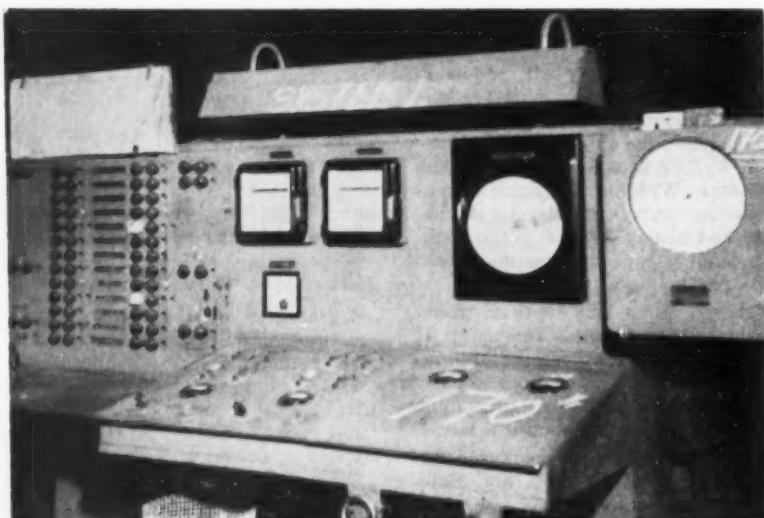
Arne Stavang

magnetite, quartz, and hornblende. Minor amounts of secondary hematite occur. Iron content (as hematite) in the Bjornevatn magnetic taconite deposit varies from 1 to 3 percent. A part of this is recovered on the magnetic separators, but nothing is at present done to save the rest of it.

#### Simple Magnetic Iron Check

Concentration is done only by magnetic separators, and the most important metallurgical check is to control the magnetite content in the products during the various stages of concentration.

Magnetite content in millfeed and tailings is determined daily by help of a Davis Tube Tester. To get a quick check on the magnetic iron in



Control panel for one of the two identical milling circuits. Permanent records of feed rate and other pertinent data are recorded automatically. To the left are matching pairs (red and green) lights for each machine in the plant. The green light burns continuously while the machine is in operation and the red one burns when it is stopped.

the separator tailings, a so-called "ferrometer" is used. The method is based on the measurement of magnetic permeability and was developed by one of Sydvaranger's electricians, R. Viik, in 1939-1940. Basically, it employs two magnetic circuits in balance. The sample is inserted in one field, and the resulting unbalance between the circuits is registered on a dial calibrated to read in percentage of magnetic iron.

Sample preparation is very simple. The sample is poured into standard cylindrical glasses, which are vibrated until an even packing is obtained. The sample must either be saturated with water or completely dry. The exactness of the test result is satisfactory with accuracy usually within 0.05 percent iron when checked against the results obtained with the Davis Tube Tester. However, the instrument is sensitive to fluctuations in line voltage and frequency. If there are line-load fluctuations, it is necessary to take several readings on each sample and to average them to obtain the final figure.

As coarse and fine magnetite grains have different apparent susceptibility, it is necessary to use slightly different correction factors for readings on primary and secondary separator tailings.

Today it is possible to construct magnetic instruments registering the total amount of magnetite loss from each separator or from the whole plant.

The ferrometer is not in general use. Only six of them have been

built, and two of them are in use in the United States.

#### Determine Liberation Size

The magnetic crystal size varies somewhat in the ore. To produce a concentrate with as uniform an iron content as possible, the grind has to be changed according to the type of ore treated. It is, therefore, important to know in advance the liberation size of the crystals. An indication of this is found by separating the minus-150-mesh, plus-200-mesh fraction of a classifier overflow sample or of a crushed ore sample from the mine in the Davis Tube Tester. The iron content in the resulting concentrate is determined by the usual chemical method and indicates the liberation size of the particular type of ore treated. This method is quite useful but is rather slow so other methods for estimating the liberation size of the crystals are being investigated.

For a more detailed investigation of concentrates, heads, and tailings, microscopic analysis is used. The separate screen fractions are divided into particle groups, i.e., with free magnetite particles only, with particles containing 75 to 100 percent iron as magnetite, with 25 to 75 percent iron, with 5 to 25 percent iron, with 1 to 5 percent iron, and with less than 1 percent iron. In this way the volume percent of each group in the different fractions can be determined by grain counting. (See *Mining World*, October 1947, page 22: Norwegians Conquer Taconite.)

The particle count does show that gangue particles with as little as 1 percent iron, as magnetite, may go into the separator concentrate. As the size of the magnetite crystals in some ore types are as small as 2 microns, it is understandable that the final concentrate at times may contain large amounts of middling particles even in the minus-325-mesh fraction.

#### Looking Ahead

Sydvaranger is not through planning, experimenting, and improving. The day will come when the open-pit mine must give way to underground operations. Already a diamond drilling program is delimiting the ore and a development program is being planned.

In the Kirkenes mill building, major changes are being made in the grinding circuit. For example, the speed of the secondary grinding mills will be reduced and the pulp density in the mills increased.

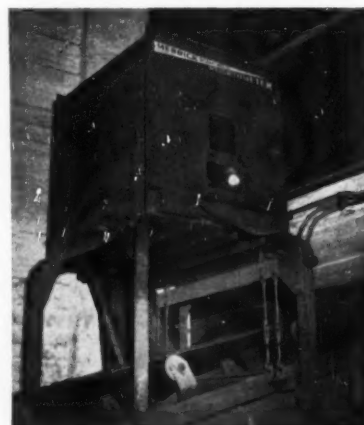
Experiments will be made with the use of cyclones in the secondary grinding circuit in the hope that grinding efficiency can be increased.

Improvements in the handling and storing of concentrate will be attempted on a full-scale commercial basis. A 50,000-ton underground storage bin recently built for final concentrate and connected to the ship loading dock by conveyors, has already increased ship loading from 400 tons per hour to about 1,000 tons per hour.

A pelletizing plant with five vertical (chimney-type) furnaces is to be started shortly and should be in operation in 1955.

No, Sydvaranger is not through building.

A final check on weight of the concentrate is made by this Merrick Weightometer. The unit is standard for all weighing of belt conveyed material throughout the operation.







## SYDVARANGER ELECTRIC POWER

# Hydro and Steam Plants Serve a Distribution System Designed To Handle Fluctuating Loads

By **ASBJORN BORSTING**  
Chief Electrical Superintendent

Production of enough electric power to mine 2,000,000 tons of ore and almost 1,000,000 tons of hard rock and to mill 2,000,000 tons of ore a year is quite an operation in itself. Hydro-electric power, thought to be so abundant in the Scandinavian countries, is not at all plentiful in this far northern section. Potentially, the only substantial source of such power in the area is the Pasvik River which forms the boundary between Norway and Russia and there are no plans for an international power plant on this river. Sydvaranger, however, does have two small hydro plants and a somewhat larger one may be built eventually.

Prior to 1920, all power was generated by steam, but in that year, during a period of very high coal prices, the small Tarnet water power station was built. The plant has two 500-kilowatt, 500-volt, 50-cycle generators driven by two Francis water turbines utilizing a head of 300 feet. The average rainfall of 16 inches furnishes water that will produce about 4,000,000 kilowatt hours per year. Water is conducted through one mile of 40-inch-diameter wood stave pipe. The company plans to rebuild this plant using one unit with completely automatic control.

### Kobholm Largest Hydro Plant

The other hydro plant, known as the Kobholm water power station, was built in 1930 during a period when hydroelectric equipment was selling at very low prices. The plant is located on the seacoast, just three miles from the Russian border, and is only accessible from the sea by steamer or motor boat.

The installation includes one 2,000-kilowatt, 5,500-volt, 50-cycle generator driven by a 2,700-horsepower Francis water turbine utilizing a 330-foot head. The water tur-

bines were manufactured in Norway by Kvaerner Brug.

The plant will produce 8,000,000 kilowatt hours annually with normal rainfall. Wood stave pipe carries the water 1½ miles over rugged country and through four tunnels to the penstock. In spite of frequent ice and rock slides, the pipe has been broken only twice in 20 years.

Since the beginning of 1952, the company has been buying, on long-term contract, 1,000 kilowatts from the government's new Gandvik hydro power station. It is connected to the mine at Bjornevatn by a 40-mile transmission line. The two hydro plants and this public power source are interconnected with the company's main source of power—the steam plant at Kirkenes.

The old steam plant was completely destroyed by war action, and only part of the exterior walls were useable in the new plant. Two Babcock and Wilcox boilers and a pair of Metropolitan-Vickers Turbo-generators produce 15,000 kilowatts of 3,300-volt, 50-cycle current.

### Generating Station

The generating station contains two Metropolitan-Vickers turbo-generator sets, each of a continuous maximum rating of 7,500 kilowatts with an economical rating of 6,000.

The two turbines are identical in design and are single-cylinder machines of the axial-flow, impulse type running at 3,000 revolutions per minute, designed for inlet steam conditions of 496 pounds per square inch and 707° F. The turbines each consist of a velocity compounded stage followed by 26 single impulse stages arranged in two groups of 11 and 15 stages, respectively. The first group and the velocity stage have wheels integrally forged with the shaft, while the second group has separate wheels shrunk on and keyed to the shaft.

Steam is bled from each turbine at two points for feed-water heating to 234° F. It is bled from a third point for evaporating boiler feed make-up water in a single-effect



Asbjorn Borsting

evaporator capable of dealing with 3,600 pounds of water per hour.

Condensate is removed by two, two-stage extraction pumps. It then passes through the cooler tubes of an air ejector, a drain cooler, and a low pressure heater to the boiler feed pump suction main, and thence through the pumps to a high pressure heater and to the boiler.

Each boiler carries 25 tons of water and there is storage for an additional 80 tons. The feed water is very clean and only small amounts of treating chemicals are used. Piping and valves are arranged to permit operating one boiler and one turbine as a unit or both can be operated in parallel.

Condensers are of the Metropolitan-Vickers central flow type, each with a cooling surface of 5,920 square feet. They are cooled with sea water that has summer temperatures of plus eight° to plus ten° C and winter temperatures of minus one° to minus two°. This gives a very high vacuum. The condenser tube nests, as well as the heat exchangers, are made from "Admiralty brass" and are practically non-corrosive in sea water. The water from Varanger Fjord seems to be very pure and no sludge is formed. During two years of operation, the practice has given no trouble.

Cooling water is delivered from the fjord, through 30-inch wood stave pipes, by a pair of Worthington, type 30-100-QBO-1 vertical turbine pumps driven by 150-horse-



This pair of Worthington vertical turbine pumps driven by 150-horsepower General Electric motors pump sea water from the fjord to the power plant for condenser cooling.

power, General Electric motors. Capacity: 4,250 gallons per minute at 59-foot head. Pumps are remote-controlled from the power house.

This cooling water is later used for milling, and a pair of Worthington, type 12-LA-4, horizontal centrifugal pumps with 350-horsepower, General Electric motors, raise it to the concentrator against a 225-foot head. These pumps have a capacity of 7,140 gallons per minute against a 246-foot head.

Each turbine is coupled through a semi-flexible coupling to a 9,375-kva alternator designed for 3,000-volt, 3-phase, 50-cylce. A closed circuit cooling system is provided for each alternator.

The main bearings are lubricated and cooled by a supply of Caltex oil provided by a gear-type pump driven from the main turbine shaft. To meet starting and emergency conditions, each turbine is provided with an auxiliary steam-driven oil pump arranged to come into service automatically should the oil pressure fall below a pre-determined figure.

Steam consumption of each turbo-generator at the economical rating of 6,000 kilowatts is 9.822 pounds per kilowatt hour and the heat consumption 11,365 Btu's per hour.

#### Modern Boiler House

Steam is generated in two Babcock and Wilcox water tube boilers with super heaters and economizers. They were manufactured in Norway by A/S Thune. Steam pressure is 42 kilograms per square centimeter; load is 40 tons per hour, and there are 790 square meters of heating surface.

Boilers are fired with coal on a

moving grate which can be regulated to move at 0 to 33 feet per hour. Depth of coal on the grate is controlled by a movable ruler which allows up to 10 inches of thickness. Air for combustion is pre-heated and led into sections under the grate. This permits manual control of combustion along the grate which runs the full length of the boiler. Fans are controlled by hand except for the smoke stack, induced draft fan which is automatic.

Two overhead coal bins for each boiler provide storage capacity for

more than one day of operation. Coal is ocean-shipped from the Norwegian Islands of Spitzbergen, and because of the short shipping season, upward of 25,000 tons are stock-piled during the three summer months. It is dozed from the stockpile onto a 42-inch conveyor which fills the bunkers. This coal has an ash content of less than 10.0 percent. It can be used without much trouble, and complete combustion is obtained.

#### Power Distribution

The entire electrical system is interconnected with lines from the two hydro plants and those from the public power system.

Lines from the company's two hydro plants and from the public utility, all at 20 kilovolts, interconnect at the main switching station at Bjornevatn. Two transmission lines link this point with the main steam plant at Kirkenes. Double bus bar arrangement makes two separate systems possible.

Ten earth cables, five for each turbo-unit, carry the current some 1,300 feet to the main distribution center in the concentrator building.

A 3,500-kilovolt-ampere transformer feeds current to the mine. In order to provide high torque for the 600-horsepower induction motor on the big primary crusher, secondary voltage is kept to 3,300 volts at no load. This falls to 3,000 volts

Interior view of the steam power generating plant at Kirkenes. The two Metropolitan-Vickers turbines and generators develop 15,000 kilowatts of power.



Trolley for the rail lines is fed at 750 volts direct current by pumpless six-phase steel tank rectifiers.

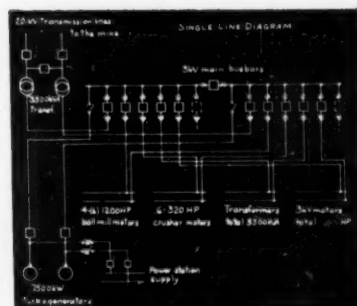
To keep transformer losses to a minimum, generator voltage is used for as many motors as possible; from this economic viewpoint, all motors larger than 100 horsepower are 3,000 volt. To standardize, 1,000 revolutions per minute motors are used where possible. On the line, starters are used with up to 200-horsepower squirrel cage motors.

The public supply system had objections to the fluctuating crusher loads, and, as the single line diagram shows, it is possible to run the 3-kilovolt and 20-kilovolt equipment as two separate systems. However, with four ball mill synchronous motors running and both hydro plants running there are no objections from the public system. When hydro stations are out of service

and both turbo-generators are operating, these are tied together on the 20-kilovolt side of the 2,500-kilovolt-ampere transformers to reduce the short circuit because the interrupting capacity of the breakers in the 3-kilovolt main bus bars is only slightly more than the system provides. The tie breaker in the main buses is closed when only one turbo-generator is running to make the starting and stopping of motors in the different motor controls easier.

All 220-volt circuits for motors, control, and lighting are of "earth cable" construction—that is, paper- or rubber-insulated, lead-covered, double iron band armored. All 220-volt fuses, buses, etc. are installed in cast iron boxes usually built into groups. The sea water used in the concentrating plant makes the air corrosive. At certain temperatures and humidities, water could condense in the enclosed systems; but, small, 1/8-inch-diameter holes in the lowest parts of the equipment, ventilate and drain the enclosures and there is no trouble.

The 1,200-horsepower ball mill motors operate at 187.5 revolutions per minute, 3-kilovolt synchronous motors. Owing to low generating capacity, the mills are started after synchronizing the motors using a magnetic clutch which is energized



### Electric Power Distribution System

by 120-volt direct current. Starting and synchronizing torque of the motor is only 40 percent; pull-out torque 200 percent. The motor control is fully automatic, and part winding start is utilized. Motors are designed for a power factor of 80 percent, and the excitation is regulated to improve the total power factor which otherwise would be fairly low due to the use of induction motors in the plant. The control has double bus bar, which is necessary when two separate electric systems are operating. Motors and control were built by Electric Machinery Manufacturing Company.

Owing to the remote location of the operation, practically all repairs must be made on the site. Shipment

A black and white photograph of a large industrial machine, possibly a steam engine or boiler, in a workshop or factory setting. The machine features a large, rounded cylindrical body with various pipes, valves, and structural supports. A prominent vertical pipe runs alongside the machine, and a horizontal pipe is visible in the foreground. The background shows a wall with a window and some structural elements. The overall scene is industrial and somewhat cluttered.

A black and white photograph of a large, complex industrial machine, likely a steam engine or boiler. The central feature is a large, rounded, cylindrical component, possibly a pressure vessel or a large valve, with a pressure gauge mounted on its side. The machine is surrounded by a dense network of pipes, valves, and structural supports, creating a complex and somewhat cluttered appearance. The lighting is dramatic, with strong highlights and deep shadows, emphasizing the metallic textures and the intricate details of the machinery. The overall impression is one of a powerful, well-used piece of industrial equipment.





One of the Metropolitan-Vickers control panels for the turbo-generator.

of equipment to Southern Norway for repairs takes many days and is possible only when standby units are available. A large and well-equipped shop is maintained for this purpose, and a much larger than normal stock of parts and supplies is kept available.

Most rewinding of motors and transformers is handled at the plant, and equipment is standardized so that the number of spare units can be held to a minimum.

#### Power for Mining

The Bjornevatn mine is an open pit shaped like a "v." At present 3,000-volt current is used for the shovels and partly for the churn drills. Current at 800 volts is being used for some churn drills and compressors.

Within six months, all power will be supplied to the mine by 3-kilovolt overhead lines. A substation will be constructed in a fairly well protected area between the two "legs" of the mine. Electricity will be supplied over a 20-kilovolt transmission line. A 1,500-kilovolt-ampere transformer steps the voltage down to 3,200; for each leg in the mine, an overhead distribution system, using impregnated wood poles, carry the phase wires and an isolated bare neutral wire. The star point of the transformer secondary is ground-connected over a 75-ohm

resistance. Where a shovel is operating, a three-pole disconnect switch is used. An SH-D rubber-covered

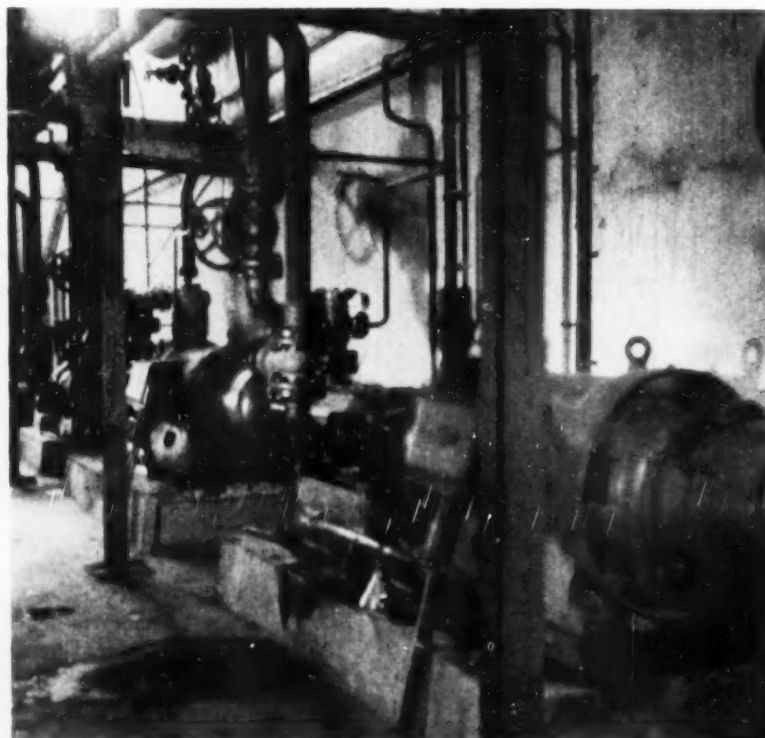
cable leads to a switch house where an overload circuit breaker protects the shovel assuring instantaneous disconnection in case of grounding of one phase. If the breakers do not open after an 0.25-second ground, the line is disconnected by a time relay in the mine substation.

The churn drills were built for 220 volts but are connected in groups of three or four to a 3,200/240-volt phase 200-kilovolt-ampere transformer having the same protective gear as the shovels.

This system of handling 3,000 volts with rubber-insulated cables should be safe for the personnel. The 220-volt current for churn drills and compressors instead of the higher 380 or 500 volt is used because any alternating current voltage above 250 in Norway is considered high tension. Strict regulations for such voltages raise costs above the saving effected in cables and control equipment.

In the winter, flood lighting of all working areas is necessary, and this equipment is made for easy transportation. All auxiliary electric equipment in the mine is being skid-mounted to facilitate moving by truck or tractor. Shift electricians use a service truck for making inspection and minor repairs on all shifts.

There are four boiler feed water pumps. Three are driven by 140-horsepower Metropolitan Vickers electric motors as shown, and the other is steam powered.

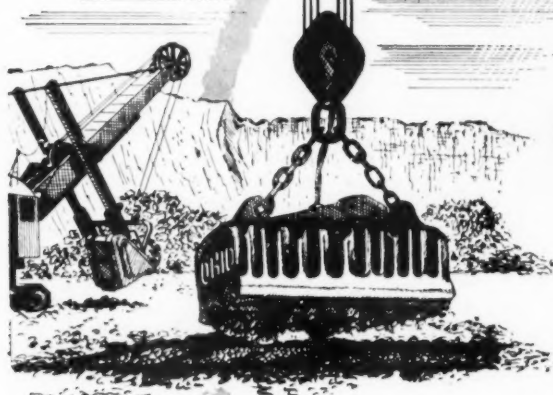




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The S. S. Varangis is an old British whaler converted to ice-breaker. While the fjord at Kirkenes is open water as a result of the tempering influence of the Gulf Stream, occasionally it is necessary to break up small amounts of ice forming around the shores.

#### SYDVARANGER MAINTENANCE

## Large Machine Shops and Huge Spare Parts Inventory Make Any Repair Easy

Port authority, director of transportation, and master mechanic are part of the names that might properly be painted on one office door in Kirkenes, Norway. The sign actually says: Ing. Seiness. Inside the office sits a genial chap named Karl Seiness, and he carries the title of Chief Mechanical Engineer. From his one flat-topped desk are handled a multitude of responsibilities which include maintenance of a large part of all equipment at Kirkenes, construction activity at Kirkenes, the railroads, the docks, receiving of supplies, the shipment of concentrate, the operation of the ship repair yard, and several others that are not necessarily related to the above. Of course his major work is the maintenance of the plants.

The superintendents of the respective plants are responsible for the maintenance of the plants. In this remote area, it is impossible to depend upon commercial shops to do repair work. Hence, Sydvaranger has provided facilities for doing virtually any kind of repair work that

could be required, in fact, some of the equipment for the new plants was built right in the company's own shops at Kirkenes. This is one of Mr. Seiness' departments.

In one shop all overhaul of locomotives, both electric and steam, and repair of ore cars are handled. In another are facilities for handling heavy steel plate and welding. The machine shop is adequately

equipped with lathes, boring machines, milling machines, drill presses, punches, etc. Similarly, the electrical repair shop of Mr. Borsting's department is set up to do almost anything required in that line, including rewinding of the big motors and transformers.

A large and rather elaborate warehousing and stores arrangement also is necessary. Over \$2,000,000 worth of spare parts and supplies are on hand at all times, and the entire stock is kept under perpetual inventory.

There is even an oxygen manufacturing plant to provide gas for welding. It is a compressor-cooler system that makes the liquid oxygen from air.

#### As Port Authority

Of equal importance and almost equal magnitude is the job of receiving supplies—all of which reach Kirkenes by water. The company maintains four quays—one for loading concentrate, one for unloading coal and heavy equipment, a third for the icebreaker and smaller vessels and a fourth which is used as a public dock.

Coal is received from the Norwegian Islands of Spitzbergen, and the ice-bound harbor there permits shipments for only about three months of the year. Some 25,000 tons must be stockpiled during this period. A 12-ton bridge crane and an 8-ton Rotary crane running on a steel bridge, both with clam shell buckets, move coal from the ship to

LEFT: Karl Seiness, chief mechanical engineer. RIGHT: Alfred Jacklin, manager of stores and warehouses. Under his direction some \$3,000,000 worth of spare parts, supplies, etc. are stored, issued and controlled by perpetual inventory.



rail cars which deliver it to the stockpile at the power plant.

At the same dock is an 80-ton derrick which is used for unloading all heavy machinery and supplies.

The icebreaker, Varangis, also is anchored at a section of this quay. She is a former Norwegian whaling ship converted for this use, and is held in service from mid-October to mid-April. However, because of the tempering influence of the Gulf Stream, the fjord is seldom frozen and the ship sees only short periods of use.

The vessel is 130 feet long, has a beam of 26 feet and 13.4 feet of draft. She is powered by a 1050-horsepower triplex steam engine, and her boilers are oil-fired. She carries a crew of six and is capable of 12 nautical miles per hour.

Actually, the Varangis is a high-cost operation. She was not originally built for ice breaking and the shape of the hull is not too good for this service. Within a few years she will probably be replaced with a Diesel-powered ship built expressly for this work.

Oil is received in tankers, and an installation for unloading is located near the coal facilities. One tank for Diesel fuel has a capacity of 1,400 cubic meters; capacity for bunker fuel oil is 7,500 cubic meters. Oil is pumped from the ships to the tanks through separate pipe lines. During nine months of the year it is necessary to provide heating for the fuel oil.

#### **Employee Welfare**

Employee welfare is more or less delegated to superintendents of the various departments where change-houses and dining rooms are concerned. Mr. Lillegraven, assistant manager, is in charge of other welfare work. To provide housing for employees in the destroyed towns that serve the operation, it was necessary for the company to erect many buildings. It has also aided employees to finance the building of private dwellings. Nearly 90 percent of the buildings at Bjornevatn belong to Sydvaranger, as do a substantial portion of those in Kirkenes.

The company maintains two well-equipped first aid stations, but major medical problems are handled in the municipal hospital. The company, however, does have a staff doctor who examines all employees at least once a year. Workmen's accident insurance is under government control.

Norway has a pension system that provides a minimum income for re-



The concentrate loading quay on Varanger fjord. Concentrate is transported from the 10,000 ton storage bin by a 42-inch conveyor belt to a pair of belts which cross the conveyor bridge (shown in raised position) and chuted into the hold of the ship.

tired persons. Women receive their pensions at age 65; men at age 70. In addition, the company has its own pension system, partly through insurance, to augment the state grant.

For men, the company retirement program goes into effect between 65 and 70 depending upon the wishes of the individual. For women it starts at age 60. The company pays the entire amount of this retirement for the first five years before the insurance program becomes effective.

In all respects, the employee rela-

tions program seems to be a well-balanced one and not too different from those common in the United States.

All of the separate plants and shops have their welfare departments with dining rooms, changing facilities, showers, etc. At Bjornevatn, a new change-house will be finished this autumn. It has facilities for 300 men and also contains offices for the mine foremen, an office for the shaft doctor, and two sun ray rooms for the workers.

One of the two large repair shops and storage warehouses at the mill in Kirkenes.



## SYDVARANGER'S PLANS



# Pelletizing Plant Underway: Underground Mine Planned in Future



The S. S. Johann Schultz out of Emden, Germany is loaded with concentrate at the rate of 1,000 tons per hour. Ships with a capacity up to 12,000 tons can be loaded at the quay which has a water depth of 30 feet at low tide.

Sydvaranger has not been completed. Although operations have reached planned capacity, there are many points which are still make-shift in nature and will be changed in order to improve efficiency and cut costs. Also, numerous experiments are always under way in an attempt to improve methods and reduce costs. In addition, there is the long-range program which must be planned against the day it will be necessary to mine ore underground.

The open-pit mine, of course, was laid out in a manner which would make the orderly development of underground operations practical.

On the south, the ore deposit borders on a small lake which bottoms on the 40-meter level. Next year, a 6,600-foot-long adit will be started at the fjord from a point five meters (15.6 feet) above sea level and driven to drain this lake. Part of the ore below this adit will be mined from the south increasing the total amount of ore which can be mined in that way.

In the Kirkenes mill building, major changes are already being made in the grinding circuit. Original

estimates of required capacity were a little on the low side. A third section, identical to the original two, is being installed because that part of the concentrate which shall be pelletized will have to be ground finer.

It is planned to try reducing the speed of the secondary grinding mill to, perhaps, 15.5 revolutions per minute (18.9 now), and to increase the pulp density in these mills. One primary mill has just been lined with Lorain plates and wedge bars to increase its capacity. Wear will be carefully checked against that of the present rail liners.

A host of ideas for improving metallurgical practice by using cyclones have been advanced, and it has been decided to experiment with them at several points in the circuit. Among the first to be tried will be:

1. The present open secondary grinding circuit will be closed with cyclones used as classifiers.
2. Pulp entering the secondary grinding mill will be dewatered by a cyclone acting as a thickener. It is hoped that this will increase grinding efficiency.
3. The concentrate may be split ahead of filtering with the coarse material being shipped to sintering plants and the fine being made into pellets.

4. The primary classifier overflow may be separated into a coarse and a fine fraction. The fine material could then be passed directly to the fine (secondary) stage of magnetic separation. This would reduce the amount of concentrate being re-ground.

Of course, it is unlikely that all of these moves will be beneficial, but they are some of the items that will be tested.

One experiment underway on a full-scale commercial basis is for the handling and storing of concentrate. A 50,000-ton underground storage bin has been built to receive the final concentrate. Concentrate comes to the bin from the dryers, with 5.0 to 7.0 percent water, via conveyor belt, and is drawn from the bin and delivered to the loading dock by another system of conveyors. The new unit went into operation in late July and immediately stepped up ship loading from 400 tons per hour to an average of 1,000 tons per hour.

A new storage bin will probably be built with a capacity of 100,000 tons of concentrate and a similar bin for pellets.

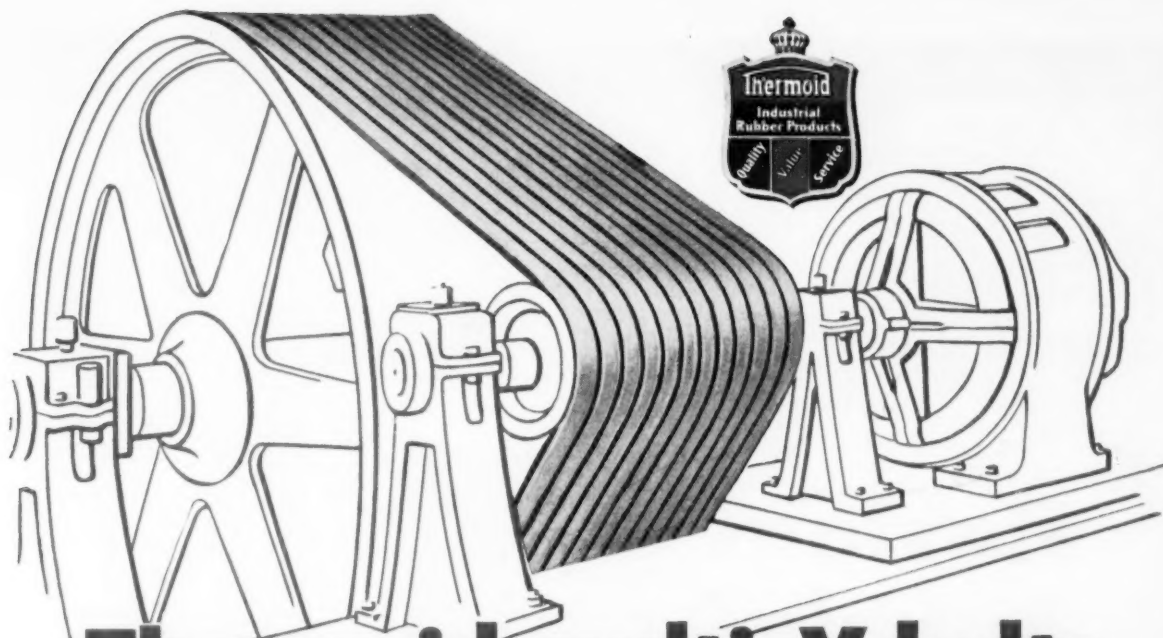
It has been definitely decided to start construction of a pelletizing plant this year. It should be in operation sometime late in 1955. Present plans call for five vertical (chimney-type) furnaces rectangular in cross section and very similar to those being used by Erie Mining Company at Aurora, Minnesota, and Bethlehem Steel Corporation at Lebanon, Pennsylvania.

No, Sydvaranger is not through building. It is not through developing; and, under its present enlightened management, it will never be through planning, experimenting, and improving. By any standard of measurement, the Sydvaranger operation today would be classed as outstanding. Examined by the cold light of day or the soft light of the midnight sun, it should continue to be outstanding—its future truly looks bright.

HANS TORGESRUD, works manager, (left) in Kirkenes keeps the concentrate flowing into the ships. JOHN HOLTEN, sales manager, in Oslo, keeps the ships sailing north to load the concentrate.







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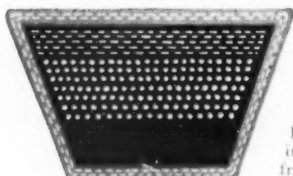
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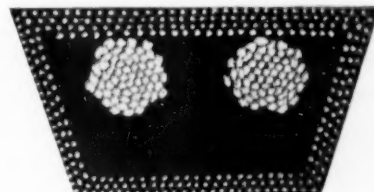
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## ACTIVITIES OF U. S. MINING MEN

**Harry J. Wolf**, mining and consulting engineer of New York, is examining extensive mineral properties in Brazil. After completing this assignment, Mr. Wolf will visit Argentina, Chile, and Peru. He will return to the United States in December.

**W. J. Rundle**, professor of mining engineering at the University of Wisconsin, will serve as chairman of the mineral engineering education division of the American Society for Engineering Education. Other officers are **W. R. Chedsey**, professor of mining engineering at the University of Illinois, vice chairman; **J. W. Stewart**, mining engineering department head at the University of Alabama, secretary; and **C. L. Wilson**, dean of the Missouri school of mining and metallurgy, council member.

**H. F. Mills**, western geologist for American Zinc, Lead and Smelting Company at Metaline Falls, Washington, recently was sent to Guatemala on an exploratory trip for the firm.

**Charles H. Johnson**, chief of the U. S. Bureau of Mines' base metals branch in Washington, D. C., recently made a visit to the Coeur d'Alene and Metaline mining regions in the Pacific Northwest.

**Joseph M. Beeston** has been appointed instructor in metallurgy at the Washington State College of Mines, subject to approval by the board of regents. Mr. Beeston will begin his duties this month after completing his Ph.D. at the University of Utah.

Members of the U. S. congressional atomic energy committee have left to inspect uranium mines in Africa. The group will visit mines in the Transvaal, the Belgian Congo, and the Orange Free State where uranium is a byproduct of gold. They will visit the famous Shinkolobwe mine of Union Minière du Haut Katanga, the world's largest uranium mine. Representative **W. Sterling Cole**, chairman of the committee, is a member of the group, along with Senators **Richard B. Russell**, **Guy Gordon**, **Burke B. Hickman**, **Chet Holifield**, **James E. Van Zandt**, and **Melvin Price**.

**John E. Kelly**, Washington, D. C., consultant in natural resources, has moved his business offices to 207 Capitol Towers, 208 Massachusetts Avenue, N. E., in Washington.

**P. J. Shenon**, consulting geologist of Salt Lake City, Utah, has returned to the United States from his second mining examination trip to Uganda, Africa.

**Kenneth L. Tatman**, former mill superintendent at the Resurrection Mining Company's mill at Leadville, Colorado, is now working as a metallurgist for the Iddorad Mining Company at Ouray, Colorado. Both the Resurrection and Iddorad firms are operated by the Newmont Mining Corporation.

**W. LUNSFORD LONG** has been named president of the newly formed Tungsten Institute with headquarters at 1757 K Street, N.W., Washington 6, D.C. Purposes of the Institute are to aid in developing the American tungsten industry and to promote use of tungsten, to foster cooperation between the industry and the federal government, and to promote improvement of members and study of metallurgy and the arts and sciences connected with the industry. In addition to Mr. Long who is vice president and general counsel of the Tungsten Mining Corporation, officers of the Institute are **Charles H. Segerstrom, Jr.**, president of the Nevada-Massachusetts Company, vice president; and **James A. White**, executive secretary and treasurer. Mr. White will be in charge of the Washington office.



**Clyde Nettleton**, former engineer for Telluride Mines, Inc. at Telluride, Colorado is now employed by the Climax Molybdenum Company at its Climax mine.

**Ross Prince** has been appointed president of the board of directors of the National copper mine of Spring Valley, Nevada. **K. F. Marquardson** was chosen vice president, and **R. C. Jensen**, secretary-treasurer. Other directors include **William Walker, Sr.**, **W. S. Lambert**, **Paul Lyons, Sr.**, and **Paul Lyons, Jr.** The board recently met to make arrangements for operation of the mine.

**Tom Rummel**, **Frank Seymour**, **Vernon Pick**, **Don Hoffman**, **Frank Cannon**, **Leo Coady**, and **Harold Worcester** are members of a newly formed Colorado Plateau uranium committee of the Colorado Mining Association. The committee will represent the association in legal matters concerning uranium claims filed on land covered by oil and gas leases and in general will represent the association in the uranium field.

**Percy W. Dayer**, vice-president and trust officer of the First Security Bank of Utah, N. A., Salt Lake City, has been elected a director of the New Park Mining Company of Utah. He succeeds **Orvel Bonnett** of Provo, Utah who has retired.

**Clyde Evans**, formerly mining engineer for Howe Sound Company's mine at Holden, Washington, is now employed by the Bonanza Lead Company which is once again operating its lead-zinc mine near Colville, Washington.

**E. E. Moore** of the U. S. Steel Corporation has been promoted to the position of assistant to the president and vice president from his former position as vice president, industrial relations-administration. Mr. Moore joined U. S. Steel Corporation in 1919.

**J. F. Wright**, employed in the engineering department at the Phelps Dodge Corporation smelter in Douglas, Arizona, retired in June. He had been with the company for 44 years.

**John A. Lentz, Jr.**, was awarded the professional degree of Mining Engineer at the University of Arizona. He obtained the bachelor's degree in mining engineering in 1933. Mr. Lentz is mine superintendent for the New Cornelia Branch, Phelps Dodge Corporation at Ajo, Arizona.

**George M. Potter** has received the professional degree of Metallurgical Engineer at the University of Arizona. He is chief projects engineer for the Foreign Minerals Region, U. S. Bureau of Mines. He received his B.S. degree in metallurgy in 1935 and his M.S. degree in 1936.

**H. W. Straley, III**, West Virginia geologist and geophysicist, spent the field season of 1953 investigating chromite deposits in North Carolina.

**Claud B. Giles** has assumed the duties of maintenance foreman at Bonnie for the Florida Phosphate Division of International Minerals and Chemical Corporation. Mr. Giles was formerly general foreman for the Republic Steel Corporation at Birmingham, Alabama. **Ersine A. Massey** has been named mine foreman at the Peace Valley mine of the same firm. He was formerly an industrial engineer for the Tennessee Coal and Iron Division of the U. S. Steel Corporation.

**CARLTON D. HULIN**, consulting geologist, has been appointed to the board of directors of Haile Mines, Inc. of New York, New York. Other directors include **K. C. Li**, chairman of the Wah Chang Corporation of New York, New York, and **Hugh W. Darling**, of the Guthrie, Darling, and Shattuck legal firm in Los Angeles, California.

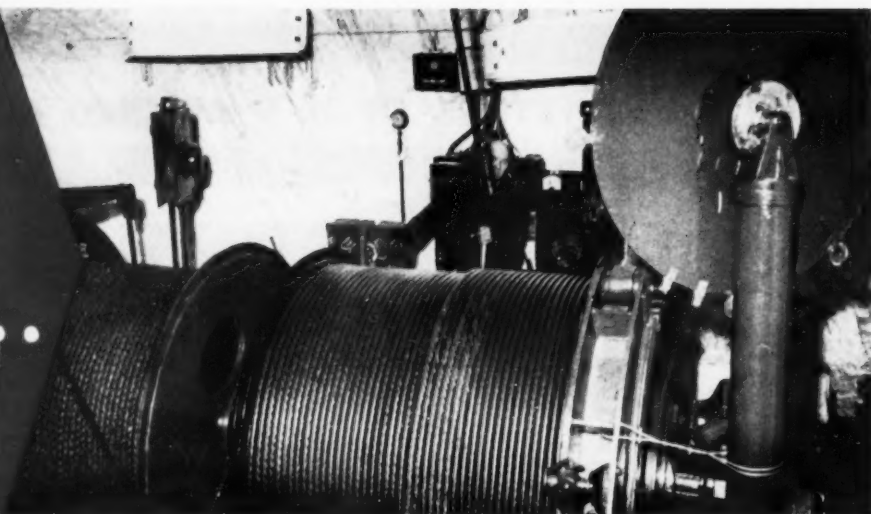


**Dean A. W. Fahrenwald** of the University of Idaho School of Mines has returned from London where his assistance had been requested in solving a complex mineral dressing problem for the Monsanto Chemical Company.

**Clarence V. Saylor** will succeed **Thomas K. Graham** as assistant general superintendent of Anaconda Copper Mining Company's Great Falls, Montana reduction works. Mr. Graham is now general superintendent.

**James P. Williams** has been appointed an assistant general superintendent of Kaiser Steel Corporation. He will be responsible for these plant departments: plant engineering, metallurgical, quality control, traffic, industrial engineering and production planning. Mr. Williams joined Kaiser Steel in 1945, coming from Geneva Steel in Utah where he had been plant industrial engineer.

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## ACTIVITIES OF INTERNATIONAL MINING MEN

**Andre L. Brichant**, Belgian geologist, is in Jakarta, Indonesia, where he is serving on the government's National Planning Bureau as the member on mineral resources. The newly created bureau will give technical advice on economic development policies to government officials. Nine foreign experts recruited by the United Nations Technical Assistance Administration comprise the bureau. Mr. Brichant has been a United Nations staff member. He has also done extensive mineral exploration work in North Africa (Algeria, Morocco, and Tunisia), Greece, Colombia, Mexico, and Canada.

**Ralph D. Parker** has been elected president of Canadian Nickel Company, Limited, a subsidiary of the International Nickel Company, Inc. Mr. Parker has been vice president and director of Canadian Nickel which conducts Inco's exploration and prospecting program.

**Raymond Brooks**, mining engineer who has been in charge of Silverside copper mine near Sinoia, Southern Rhodesia, is returning to his Southern Rhodesian position in November after spending a year's leave in the United States. He has visited Nevada, Arizona, and the East Coast.

**Charles S. Phillips** will be employed by the Kaiser Bauxite Company in Jamaica as operations assistant for the Kaiser plant at Spur Tree, 60 miles from Kingston. He has been mine superintendent of Virginia-Carolina Chemical Corporation's Clear Springs mine near Fort Meade, Florida.

**Dr. Recep A. Safaglu**, Eti Bank engineer and metallurgist, has returned to Ankara, Turkey, after an extensive business trip through Belgium, France, and Germany. Before making his European trip, Dr. Safaglu spent many months at the Murgul copper mine smelter in northeastern Turkey.

**Jacob Freedman** is now in Israel where he will make a general reconnaissance of mineral resources and appraise deposits for possible commercial development. Mr. Freedman, U. S. Geological Survey geologist, also will investigate known deposits of iron, manganese, kaolin, and rock phosphate. He hopes to organize three field parties of Israeli geologists to make detailed surveys. During his one-year assignment, Mr. Freedman will be stationed at Tel Aviv. He is the first U.S.G.S. technician to go to Israel at the request of the Israeli government and the Technical Cooperation Administration.

**Ian M. McLennan**, general manager of Broken Hill Pty. Co. Ltd., has been appointed a director of the company. He succeeds Sir Lennon Raws who has resigned after serving for 14 years.

**Leon Bruneel**, president of the Gold Mines of Kilo-Moto, recently made an inspection tour of the company's mines in Elisabethville in the northern part

**W. H. MARQUETTE**, consulting engineer of Seattle, Washington, has been in Sucre, Venezuela, working on the development of a large sulphur deposit. Mr. Marquette states that there are plans to do extensive diamond core drilling as soon as the rainy season is over. There are miles of outcroppings all along a major fault and the development should prove a large deposit, according to Mr. Marquette.



of the Belgian Congo. The company operates both placer and underground mines.

**E. S. Barton** of Vancouver, British Columbia has been appointed field engineer for Tasman Pulp and Paper Company, Ltd., in Auckland, New Zealand.

**Merle H. Guise**, consulting mining engineer, has recently returned to New York from a trip to the Territory of Amapa, Brazil, where he had been examining tin, tantalite, and columbite deposits.

**Paul F. Armstrong**, Canadian mining geologist, is assisting the Turkish government with its field work in evaluating ore deposits, particularly chromite, lead, and zinc, and is prospecting for new mineral reserves. Mr. Armstrong, a United Nations technical assistance expert, will work in coordination with the government's Scientific Department of Mining Research and Exploration Institute, a state-operated organization. Mr. Armstrong has served as a consultant for various companies and government bodies in Brazil and Canada.

**John K. Gustafson** of the Raw Materials Advisory Committee, U.S. Atomic Energy Commission, is on a business visit to Australia.

**Hugh M. Roberts**, mining geologist, recently spent six weeks on a consulting mission at a property in French West Africa. He also visited mines in Brazil and Australia.

**K. P. Chikara**, consulting geologist of Salisbury, Southern Rhodesia, has completed a mineral survey in Portugal and an investigation of gypsum deposits in Egypt.

**H. K. S. Ph. Begemann**, manager of the Onverdracht mine, is on leave abroad. P. Prijdekker will replace Mr. Begemann temporarily.

**Robert D. O'Brien** is in Japan serving as assistant territorial supervisor of export sales for Elmo Corporation of Salt Lake City, Utah. His headquarters will be in Tokyo. Mr. O'Brien has been with Anaconda Copper Mining Company at Butte, Montana, the U. S. Bureau of Mines in Helena, Montana, the Bres Mining Equipment Company, the Lucky Friday Silver-

Lead Mines, and the Highland-Surprise Consolidated Mining Company, all in the Coeur d'Alene district of Idaho.

**J. Fred Williams, Jr.**, associate professor of mining and metallurgy at Washington State College, will fill a faculty post at the University of the Philippines for the coming year. He will be assisting in a program to rehabilitate the war-devastated university. The program is sponsored and financed by the Mutual Security Agency and directed by Stanford University.

**Howard S. Stafford** and **Harry Puttuck** are in the Philippine Islands for the U. S. Atomic Energy Commission. They will explore the area for uranium with a team of Filipino geologists.

**J. H. G. Fuchter** is with the Kamati Tin Mines, Ltd. of Southern Rhodesia.

**C. R. Hilton** has retired as general manager of Mount Isa Mines Ltd., Queensland, Australia. Mr. Hilton is on a world tour at the present time. New general manager and director for Mount Isa is **K. B. Gross**. He is also chairman of directors of Mount Isa's subsidiary, Bowen Consolidated Coal Mines, Ltd.

**Rudolf Gerner** has joined the Benguet Consolidated Mining Company of Baguio, Philippine Islands, as a millman. He has been connected with various mining companies in the United States. In pre-war days, Mr. Gerner was mill superintendent at Surigao Consolidated Mining Company.

**C. A. Weekly** has joined the staff of the Atlas and Development Company, a Col. Andres Soriano enterprise of the Philippine Islands. Formerly he was chief of metallurgy of the mining department of Marsman and Company, as well as general superintendent of its subsidiary, Itogon Mining Company.

**Pushpa B. Malla** of Nepal, **C. P. Diskul** and **C. Nilkuha** of Thailand, have been studying mining and ore dressing in the United States. Their year-long visits are sponsored by the Mutual Security Administration and the State Department's Point Four program. Recently, they worked out of the Spokane, Washington, office of the Bureau of Mines' Northwest mining division. All three visitors compared the high degree of mining development in the United States with their own virtually undeveloped mineral resources.

**W. G. Brissenden** has been assigned to the position of assistant manager for Gaspe Copper Mines, Ltd., Quebec. Mr. Brissenden has been supervising the firm's operations on the Gaspe Peninsula including the developing and equipping of a large low-grade copper mine. **John Metz** has been appointed manager of these operations. He was formerly assistant general manager of the Tsumeb Corporation in Africa.

## Special Type Crusher Plates Built to Your Order with MANGA-TONE N. M. . . .

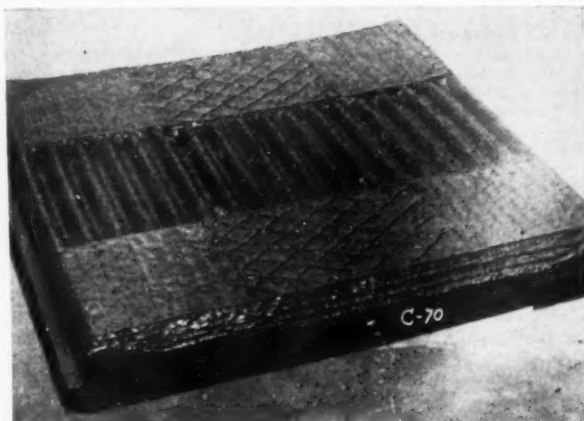
Every operator of crushing equipment has wanted many times to alter the crushing surfaces of the jaw crusher to more efficiently handle the material being crushed.

Heretofore the only way this could be done was to have the special casting made and usually the pattern costs were prohibitive.

Now your Two-Tone Shop is fully capable of rebuilding any worn standard crusher plate to your own style or design and at costs that will not be out of reason.

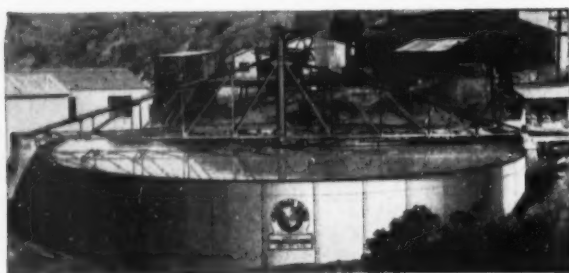
The 24x36 crusher plate illustrated originally had standard corrugations running full length. A Two-Tone Shop rebuilt the worn plate to this design and the operator reported the following results:

Normally two stationary jaws were worn out to one movable plate. But the specially built stationary plate pictured lasted exactly as long as the movable plate, which meant a 50% saving in the cost of stationary plates.



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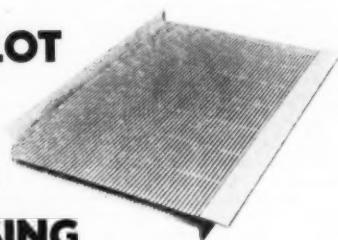
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For more efficient drainage, wet screening and heavy media recovery operations, Hendrick has developed two new types of heavy-duty Wedge-Slot Screens.

The profile bars (C-12 and CH-12) for these screens have their head flanges so designed that uniform width of slot opening is maintained until the entire head of the bar is worn down. Preparation plants in the iron range using these types of profile report that the screens have been used for a full season of continuous processing without requiring any maintenance or repair.

Both types are of similar design, but CH-12 has an extra large head flange to provide maximum resistance to abrasion on jobs with especially heavy loads of abrasive material.

If you will let us know what performance you are getting from your present equipment, we shall be glad to suggest how Wedge-Slot Screens might be utilized to advantage to increase production and minimize down time.

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# INTERNATIONAL PANORAMA



**MEXICO CITY**—The government has granted tax relief to small and medium-sized mining companies. An estimated 24,000,000 peso annual tax payment will be saved the companies.

**MONCORVO, PORTUGAL**—Production of hematite iron ore is being doubled here to an annual rate of 150,000 tons. First large-scale mining for export was started in 1952.

**SAN FRANCISCO, CALIFORNIA**—For the first six months of 1953 production of primary aluminum in the United States was the highest in history, for a similar period, at 598,704 tons. This is more domestic aluminum than was produced in the entire years of 1945, 1946, or 1947.

**MARCONA, PERU**—Iron ore mining and shipping has reached a 5,000-ton-per-day rate by the Marcona Mining Company. All shipments are going to the Fairless Works of the United States Steel Corporation at Morrisville, Pennsylvania. First shipment was made in May.

**KITWE, NORTHERN RHODESIA**—N'changa Consolidated Copper Mines, Ltd. is planning the development of an open-pit copper mine to supplement its underground production. It will be the first open pit in the Rhodesian "Copper belt."

**RIO DE JANEIRO, BRAZIL**—A contract between the government of the state of Mato Grosso and the United States Steel Corporation has been approved for the mining of manganese ores at Urucum. U. S. Steel will be required to mine a minimum of 50,000 metric tons annually.

**KUALA LUMPUR, MALAYA**—Joint plans have been made by Renong Tin Dredging Company Ltd. and Straits Tinfields Ltd. for moving and operating the Renong Tin dredge No. 1 from Gombak to Jinjang.

**BATHURST, NEW BRUNSWICK**—Keymet Mines Limited has started construction of a 200-ton-per-day lead-zinc mill. It is scheduled to be the first mill in operation in the recently discovered lead-zinc district.

**JOHANNESBURG, UNION OF SOUTH AFRICA**—Loans totalling \$60,000,000 have been made by the International Bank For Reconstruction and Development to the Union for expanding railroad transportation facilities and increasing electric power supplies for the new gold-uranium mines of the Orange Free State.

**SAN FRANCISCO, CALIFORNIA**—All metals and minerals functions of the defunct Defense Materials Procurement Agency have been taken over by the Materials Division of the General Services Administration.

**KIRKLAND LAKE, ONTARIO**—Lake Shore Mines Limited is starting development of its 8,075-foot level. This is the deepest that mining has been conducted in North America.

**SUPERIOR, WISCONSIN**—An all-time, 24-hour loading record was established recently when 262,184 tons of iron ore were loaded into Great Lakes ore carriers from the Great Northern Railroad loading docks.

**MOAB, UTAH**—The Utah Exploration Company has announced plans to build a uranium processing plant near here to treat ore from its Mi Vida mine. Since first ore shipments early this year, the mine has produced more than \$1,000,000 worth of ore which was purchased by the United States Atomic Energy Commission.

**MEDELLIN, COLOMBIA**—The Colombian government has established Free Market sales of gold. Initial sales commanded a premium of \$10.00 per ounce over the fixed United States price of \$35.00.

**PAINESDALE, MICHIGAN**—Copper Range Company has agreed to mine and deliver 8,000,000 pounds of copper, at 32 cents per pound, from its high-cost Champion mine to the federal government. Deliveries will end automatically on December 31, 1955.

**SHIPROCK, ARIZONA**—The Navajo Uranium Division of Kerr-McGee Oil Industries, Inc. has signed a contract with the United States Atomic Energy Commission for construction and operation of a uranium plant. It will be the 10th Colorado Plateau uranium plant.

**SAN FRANCISCO, CALIFORNIA**—Steel production in the United States in the first seven months of 1953 was 67,229,936 tons—the largest amount ever made in a comparable period of time.

**PLANT CITY, FLORIDA**—The Smith Douglas Company has purchased the mines and plants of the Coronet Phosphate Company for \$6,350,000. Coronet normally produced 10 percent of the crude phosphate produced in the United States.

**CARLSBAD, NEW MEXICO**—International Minerals & Chemical Corporation's Potash Division set a new hoisting record—8,000 tons from one shaft in one day—shortly after a new and larger skip and increased power for the hoist had been installed.

**NEW YORK, NEW YORK**—Imports of zinc into the United States set a new monthly high in June when 45,226 tons of zinc in ores and concentrates and 39,031 tons of zinc metal were imported. Six-month imports totalled 383,769 tons compared with 249,818 in the same period of 1952.

**WASHINGTON**—Purchasing goals on 50 percent of the 76 critical minerals and materials have been 75 percent filled, according to the Office of Defense Mobilization. For the fiscal year started July 1, \$800,000,000 will be spent for stockpile purchases. Stockpile goals probably will be met by June 1954.

**BELGRADE, YUGOSLAVIA**—The Rudnici Bakara i Topionice Bor is enlarging the capacity of its copper flotation mill from 4,000 to 7,000 tons per day to make profitable the treating of lower grade ores.

## Newmont Group Options Rhodesia Copper District

An option on the Copper Queen and Copper King claims in the Lomagundi district of Southern Rhodesia has been acquired by the Safari Exploration Company, Ltd., which is associated with the O'okiep Copper Company, Tsumeb Corporation, Ltd., and the Newmont Mining Corporation.

The company now holds exclusive prospecting rights over 100 square miles covering a part of this copper-bearing district. Large-scale field investigation has been started and is to be followed by an extensive diamond drilling program.

These claims were last worked in 1928 on a small scale, when an oxidized deposit of 1,500,000 tons was stated to have been proved, containing 2.2 percent copper, 2.3 percent lead, and 2.2 percent zinc. The sulphide zone was also drilled during that period and found to contain 2.6 percent copper and 4.8 percent zinc. Should the present exploratory program prove the persistence of the deposits in depth, the Copper Queen and Copper King could become important producers in Central Africa.

## Uranium Price Extended

The United States Atomic Energy Commission has extended its domestic uranium ore buying program for Colorado Plateau ores until March 31, 1962. Prices remain the same—from \$1.50 to \$3.50 per pound of U<sub>3</sub>O<sub>8</sub> depending on grade, allowances, and premiums.

The bonus for eligible new production has been extended through February 28, 1957. Bonus payments continue from \$1.50 to \$3.50 per pound of U<sub>3</sub>O<sub>8</sub> depending on grade of acceptable ore.

## Uranium Miners Paid Over \$2,000,000 in Bonuses

Bonuses to uranium miners on the Colorado Plateau for ore produced from eligible properties have amounted to \$2,162,378 since the program was put into effect on March 1, 1951 by the United States Atomic Energy Commission. The AEC has certified 302 properties as eligible for payments and a total of 1,374 individual payments have been made. To date, 35 new properties have produced more than the initial 10,000 pounds of uranium and the operators have received full benefit of the initial bonus. Payments are made at the rate of approximately \$150,000 per month.

The program was established to encourage private industry to locate new deposits of uranium ore and to help defray part of the high initial cost of putting a mine into production. Bonus payments doubled the base price for the first 10,000 pounds of contained uranium oxide produced and sold from any new property, and amount to a bonus of between \$15,000 and \$35,000 depending on grade, for first production from new properties.



How Dorrco Worldwide engineering serves the mining industry throughout the world . . .

## Roasting Copper-Zinc Concentrates in Japan\*

**PROBLEM:** To provide a satisfactory means of roasting 83 metric tons per day of complex copper-zinc concentrates to permit selective electrowinning of copper and zinc from the same solution. The client had been producing copper for many years but had previously been unable to recover zinc.

**HOW THE JOB WAS HANDLED:** The client made initial contact with The Dorr Company in Stamford after hearing of the FluoSolids process during a visit to the United States. Arrangements were made to ship a sample of the ore to The Dorr Company's Westport Laboratories for preliminary testing to determine the feasibility of the project. Testing was carried out

both in Japan by the client and at Westport by The Dorr Company on roasting the ore by the FluoSolids process and on leaching the resulting calcine to determine solubilities. During the major portion of the tests, one of the client's engineers visited at Westport so that he would be completely familiar with results.

The combined test procedures proved the practicability of the FluoSolids process on this operation and a proposal was submitted for a complete FluoSolids System. It proved to be most advantageous to the customer to furnish design and engineering from Dorr in Stamford, and to manufacture the Reactor and a number of components locally in Japan.

Materials and auxiliary equipment not immediately available locally were furnished from the U. S. by Dorr. A Dorr engineer was sent to Japan to familiarize operating personnel with equipment and assist with initial operation.

Meantime, our Associates in Japan, Sanki Engineering Co., Ltd., worked with the client on the design of several phases of the leaching plant and supplied the majority of the leaching equipment which was manufactured locally.

Now in full operation, the plant represents the world's first successful roasting of copper and zinc with electro winning of both metals.

FluoSolids is a trademark of The Dorr Company, Reg. U. S. Pat. Off.

This is but one example of how the flexibility of the Dorrco Worldwide engineering organization has worked to the advantage of a client. It can work for you too, through any of the following Associated Companies and Representatives, all with facilities for local manufacture.

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## INTERNATIONAL NEWS

### Mexican Tax Rebates For Smaller Mine Operators

On July 29 the President of Mexico issued an edict granting substantial tax rebates to small- and medium-sized mining operations. The government termed the action a "subsidy" but in reality it was only a reduction on the existing production (severance) tax and export tax.

The tax rebate is based on the "net perception" for production and export taxes generally varies between 95.0 and 99.6 percent of the total of these two taxes while the remainder goes to the States and Municipalities. On July 11, 1953 the State and municipality deductions were: Gold, 2.0 percent of tax; silver, 5.0 percent; copper, 1.55 percent; lead, 0.77 percent; zinc, 0.4 percent; tungsten trioxide, 0.8 percent; manganese, 0.75 percent; and mercury, 1.0.

The "net perception" for the Federal government is based on the 10.0 percent production tax, the 15.0 export tax together with the 15 percent ad valorem tax, and the supplementary tax on gold with its 10.0 percent additional tax.

Here's how the new "subsidy" works for a mine having a "net perception" tax of \$30,000 pesos per month:

\$30 (000) pesos
× 0.375 (Section II of Decree)
11.250
75.00 of base diminishing to 0 when Federal net perception is \$200,000
-11.25
63.75 or 63.75 percent of \$30,000 pesos is "subsidy."

Many mining companies in Mexico have been quick to point out that for both small and large operators a much better stimulant to mining would be to base both production and export taxes upon the net smelter returns, not upon the valuation of the mineral content, as the latter bears no relations to costs and/or earnings.

### Japanese Diet Decontrols Gold—Free Sales Allowed

Gold was decontrolled in Japan on August 1 after many long years of negotiations between the producers and the National Diet.

Major revised points are: (1) that domestic gold producers shall be forced to respond to the government order which requires that 33 percent of the annually mined new gold must be sold to the government at 405 yen per 1.0 gram for the purpose of the monetary fund; and (2) in cases where Japanese gold smelters import gold from other countries and export a part or a whole of the refined gold from the imported ore to the partner of the contract, subject to the contract, that gold production shall be excluded from the firm's monthly production.

According to the revised provisions, gold producers may sell 67 percent of their new production at the price set by the producers freely on the first day of the month. One of the leading gold producers, Sumitomo Metal Mines Company, priced its metal content at 555 yen per 1.0 gram ex-refinery during the whole month of August.

Gold producers are now studying ways of lowering production costs. A few mines, such as Konomai mine (Hokkaido) of Sumitomo Metal Mines Company, Mochikoshi mine (Shizuoka) of Chugai Mining Company, and Nakse (Hyogo) of Nihon Seiko Company, have operated at a profit, while other mines have been forced to operate under unprofitable conditions, even though the gold price was decontrolled.

The Konomai mine which is producing 40 percent of the total Japanese production, has large ore reserves containing 7.7 grams per ton and is now planning to increase production to 1,300 tons from the present monthly rate of 1,000 tons.

### Lead-Zinc Hearings Start Nov. 3 in Washington

Public hearings held by the United States Tariff Commission on facts relative to production, trade, and consumption of lead and zinc in the United States will begin on November 3 with respect to lead, and November 5 with respect to zinc. Hearings will open at 10:00 AM on these days in the Hearing Room of the Tariff Commission, 8th and E Streets, N. W., Washington, D.C.

Interested miners desiring to appear and give testimony should notify the secretary of the Commission in writing at its offices in Washington, D.C. in advance of hearings.

The investigation being conducted by the Senate Finance Committee and the House Ways and Means Committee, of which the public hearings are a part, will take into account all factors affecting the domestic economy, including the interest of consumers, processors, and producers. Upon completion of the hearings, the Tariff Commission will submit a report of the results to the Senate Finance Committee and the House Committee on Ways and Means. The report will include a statement of findings as to the effect upon the competitive position of the domestic lead and zinc industries of the present tariff status of imported lead and zinc.

### Mozambique To Have First Uranium Plant

Mozambique's first 100-ton-per-day gravity concentration plant is being erected at the Mavuzi uranium mines north of Tete by the Entrepoto Commercial de Mocambique, S.A.R.L. The mill will treat disseminated uranium ore, as well as eluvial rubble layers. Operation is expected by the end of this year.

The ore to be treated is mainly davidite, a rare mineral similar to ilmenite, con-

taining an average of 6.0 to 10.0 percent  $U_3O_8$ , with exceptional ore carrying up to 13 percent. Considerable development work was carried out on a lode at Mavuzi containing this disseminated davidite. Originally discovered in 1947 by Senhor Mario Canuto de Carvalho, a number of davidite-bearing veins and zones since have become known in the Aureole, on contacts and in shear-zones of a vast gabbro-anorthosite complex in the Tete district. The extensive rubble layers have been worked since 1947 by five small operators on a very limited scale.

### Aerial Survey of Angola Proceeding on Schedule

The joint E. J. Longyear Company-Aero Service Corporation geological survey of Angola and Portuguese East Africa (Mozambique) is proceeding on schedule with aerial photographing of 40,000 square miles of Angola completed. The photographs were made from a height of 25,000 feet with each photograph covering an area of about 35 square miles.

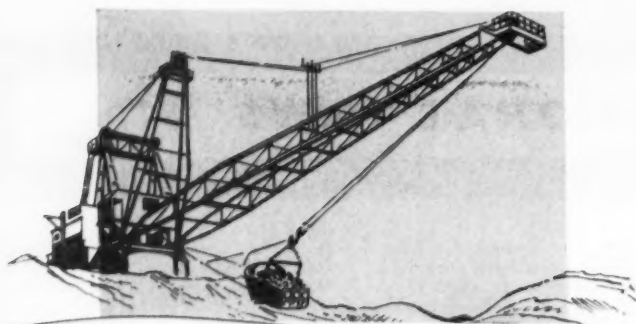
Geologists are now studying the photographs stereoscopically to gain geological data. Experience has shown that air photographs of the area give important geological data which is hidden by the brush and jungle to ground observers. Ground party surveying has been stepped up during the dry season.

The latest addition to the Longyear staff in Africa is Kenneth E. Eade as senior geologist. He is a graduate of Queens and McGill Universities in Canada and was formerly a resident of Toronto. Melvin Brugger, formerly a consulting geologist in Colorado, heads the geologic party in Africa.

### Colombia Establishes Free Gold; Coinage Planned

Effective July 22, 1953, the Colombian Government established the free sale of gold, thus making it possible and legal for anyone to buy and hold gold within the country. Gold producers now have complete freedom to either sell their product to local buyers in exchange for Colombian currency, or to export their product and receive United States dollars or any other foreign currency in exchange. The selling price is determined by free market conditions.

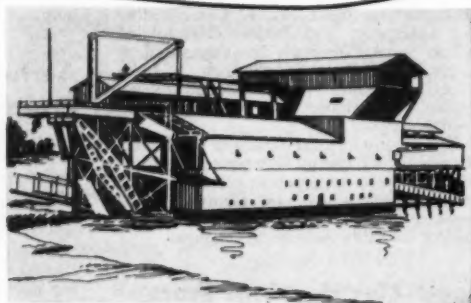
Foreign currency derived from the sale of gold is free from all currency exchange regulations and taxes—that is, dollars obtained from the sale of gold can be used abroad for any desired purpose and need not be returned to Colombia. Therefore, these funds sell at a varying premium over and above the official exchange rate of 2.50 Colombian pesos per one United States dollar. Although the sale of funds derived from the exportation of gold is just getting underway, present returns to the gold producer represent a premium of approximately 28 percent over and above the official price of United States \$35.00 per ounce, or an equivalent price of about



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United States \$45.00 per ounce of gold in Colombian currency.

The Colombian Association of Miners is preparing to privately mint 1.0 ounce, 0.50 ounce, and 0.25 ounce gold coins, which it is expected, will facilitate the sale of gold to individuals and will find free circulation despite the unofficial nature of the coins. It is expected that the present price received by gold producers will increase as the new gold market seeks its natural levels. The new free gold market replaces the 30.00 pesos per ounce premium that was being paid to gold producers as reported in the March 1953 issue of MINING WORLD, page 59.



**OCEANIA**

**WESTERN AUSTRALIA**—Hill 50 Extended has been formed to explore, test, and develop gold properties adjacent to the spectacular Hill 50 mine at Mount Magnet. Initial work will involve mapping and geological analysis, followed by diamond drilling where warranted. It is expected that 10,000 feet of drilling will be necessary.

**NORTHERN TERRITORY**—Considerable interest, some of a speculative nature, is being shown in a number of Territory undertakings, especially near Tennant Creek. Merloo Gold Mines N.L. reports having struck what appears to be another lode at the 200 level of the Enterprise lease at Tennant Creek. An orebody 40 feet by 25 feet by 8 feet is thought to average 1.0 ounce gold per ton. Central Scheelite N.L. has taken an option over the Patties mine between the Eldorado and Enterprise leases. Eldorado T.C. in four weeks to July 14 treated 1,108 tons for 441 ounces bullion. Although the Territory offers great possibilities for new mineral discoveries, it reportedly places great obstacles in the way of all but the richest producers because of distance from main centers, general lack of water, and difficulties in obtaining staff, especially high-class technical men.

**FIJI ISLANDS**—In the year to June 24, Emperor Gold Mining Company Ltd. at Vatukoula milled 156,982 tons for 57,221 ounces of fine gold. Last year the firm milled 151,000 tons for a recovery of 51,666 ounces.

**NEW SOUTH WALES**—Mineral output for the state during the first five months of the year was as follows: lead 79,209 tons; zinc 67,885 tons; copper 1,289 tons; gold 9,260 ounces; silver 2,900,303 ounces; cadmium 273 tons; and sulphur 61,397 tons.

**QUEENSLAND**—In July Mount Isa Mines Ltd. milled 51,830 tons of lead-zinc ore and 44,720 tons of copper ore for production of 2,785 tons of lead, 3,721 tons of zinc concentrates, and 1,460 tons of copper. An initial shipment of blister copper has been received at the custom refinery at Port Kembla, New South Wales, previous production having been exported because of the temporary saturation of the Australian copper market.

**TASMANIA**—Electrolytic Zinc Company of Australasia Ltd. produced 87,356 tons of zinc in the 1952-53 year compared with 83,501 tons in the previ-

**MINING WORLD**

ous year. The plant is at Risdon, near Hobart. The company's west coast mines near Rosebery milled 168,761 tons of ore to recover 9,330 tons of lead concentrate, 48,004 tons of zinc concentrate, and 4,361 tons of copper concentrate. Zinc concentrate is treated at Risdon, the others are exported.

**AUSTRALIA**—Final statistics for 1952 metal production within the country are now available: lead concentrate 233,040 tons, compared with 224,799 tons in 1951; refined lead 159,617 tons, compared with 166,902 tons in 1951; zinc concentrate 201,152 tons compared with 194,718; copper production 18,841 tons compared with 12,483 tons (copper output is still increasing because of the Mount Isa smelter). Refined tin remained low at 1,699 tons compared with 1,459 tons last year. Indications are that there may be a serious decline in tin output this year following price declines. Many small producers have signified that they cannot continue operations.

**TASMANIA**—Output of Mount Lyell Mining and Railway Company Ltd. at Queenstown was higher for the nine months ended June 30 than for the corresponding period last year: concentrates, 21,520 tons from 1,077,318 tons of ore; blister copper, 6,862 tons; gold, 4,296 ounces; silver, 17,720 ounces. During the year leeway in treating unsmelted concentrates was largely made up, with only 300 tons of copper on hand in concentrates at June 30. The coke supply position has improved and it is no longer necessary to send concentrate to Port Kembla, New South Wales.

**SOUTH AUSTRALIA**—Mineral production for the state set a record in 1952 with a value of £A6,047,000. Iron ore production totaled 2,683,966 tons—another record; the next highest was in 1939 with 2,571,759 tons. Limestone output was 417,531 tons and gypsum 164,825 tons.

**NORTHERN TERRITORY**—In the year ended June 30, *Australian Development N.L.* at Tennant Creek treated 15,790 tons of ore to recover 39,702 ounces of gold. In the four weeks to August 15, the mine produced 3,759 ounces from 1,040 tons of ore.

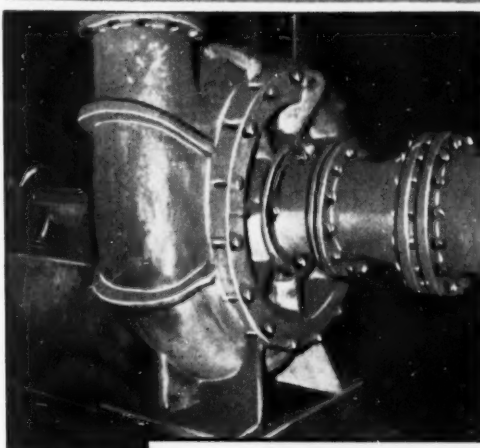
**FIJI ISLANDS**—In the year ended June 25, 1953, *Loloma (Fiji) Gold mines N.L.* at Vatukoula produced 19,097 ounces of gold from 19,413 tons of ore. Last year, the firm recovered 24,039 ounces of gold from 15,825 tons of ore.

**WESTERN AUSTRALIA**—*Linden (W.A.) Gold N.L.* whose mine is at Yundamindera will sink a shaft on its south lode. The company holds the *Queen of the May* mine and largely depends upon old records for information. An examination was recently completed by M. R. McKeown, consulting engineer of Melbourne.

**SOUTH AUSTRALIA**—Pilot plant concentrates are being produced at Radium Hill and these are being further treated for production of uranium. A water pipe line is being laid from Morgan to the townsite, a distance of 138 miles. The town now contains 120 houses and quarters for 600 employees. The South Australian Department of Mines has called for bids for construction work at Port Pirie in connection with the uranium treatment plant which will be supervised by the *Broken Hill Associated Smelters Pty. Ltd.*

OCTOBER, 1953

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NEW SOUTH WALES—*Tungsten Consolidated Ltd.* at Frogmore, in four weeks to August 5, milled 232 tons for a recovery of 4.8 tons of first-grade concentrate valued at £A5,900. Flotation has increased grade to 72 percent WO<sub>3</sub>. Further contracts have been made for the sale of 10 tons at an increase of 10/ in the price (335/).

VICTORIA—*Morning Star (G.M.A.) Mines N.L.* at Wood's Point continues to mine ore assaying above 1.0 ounce per ton at a rate of 1,600 to 1,700 tons per month. This is one of the state's oldest producers. At the *Spring Hill (N.T.) Gold Mines N.L.*, a drill hole is being sunk for water. Victorian interests now control the company.

NORTHERN TERRITORY—Shareholders in *Falcon Gold Mines N.L.*, which has scheelite leases at Mosquito

Creek, refused to adopt a directors' proposal at the company's annual meeting that the company wind up its affairs voluntarily. The company is one of many with headquarters in Adelaide, South Australia, and interests in the Northern Territory. Distances involved and other operating difficulties give rise to many problems which have been accentuated by falls in the price of metals other than uranium.

AUSTRALIA—An Australian expedition will explore the Antarctic for uranium and other minerals. The expedition is expected to sail from Melbourne toward the end of the year. Mechanized sleds, radios, planes, Geiger counters, and electronic equipment will be used in the search. Robert Dovers, a New South Wales surveyor and explorer, will head the group.



NORTH AMERICA

ONTARIO—*Lake Shore Mines Limited* reached the deepest point in North American mining when its inside No. 4 shaft reached the 8,075-foot level recently. The shaft will be continued 60 or 70 feet below this level to permit installation of a loading pocket and sump. The shaft, ore passes, and ventilation raise up to the 7,825-foot level are expected to be completed by the end of the year. Crosscuts to the orebody at the new 7,950 and 8,075 levels will take about three months to drive. After shaft sinking is completed, development work will be resumed on the levels between 7,325 and 7,825 on the new deep No. 4 ore zone.

ALASKA—*Harvey Aluminum, Inc.*, has requested a preliminary permit from the Federal Power Commission to investigate the possibilities for a hydroelectric project on the Copper River in Alaska. The permit merely gives Harvey priority over the site in making its surveys. A permanent FPC license would have to be issued before building could start. The firm declared that electricity from the project would be used by electrochemical and electro-metallurgical industries and for other purposes. Potential output would be 7,000,000,000-Kwh per year.

ONTARIO—*Conecho Mines Limited* has acquired a contiguous 35-claim group of approximately 1,400 acres in the new Algoma uranium district of the Sault Ste. Marie-Sudbury mining division. *Technical Mine Consultants Ltd.* is preparing an exploration program of preliminary prospecting and mapping, including both geiger and airborne scintillometer surveying.

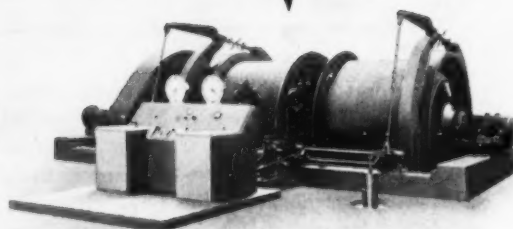
BRITISH COLUMBIA—*Silver Ridge Mining Company, Ltd.* is considering construction of a concentrator to treat ore developed in its "Wonderful" vein at Sandon. Management has not been able to arrange for custom milling. Meanwhile extensive diamond drilling is underway. John R. Denney is managing director.

IDAHO—A second electric furnace will be added to the installations of *Monsanto Chemical Company* at Monsanto, Idaho, where elemental phosphorus is produced. The new furnace will increase the company's number of electric furnaces to eight, six of which are at Monsanto, Tennessee. The first furnace at the Idaho plant went into production in December 1952.

NEW BRUNSWICK—*Cyprus Exploration Company*, wholly owned subsidiary of *Cyprus Mining Corporation*, will provide funds to *Fundy Bay Copper Mines* for exploration of the *Meadow Brook* property 40 miles south of Dalhousie. A resistivity survey is reported to have outlined a strong anomaly 3,000 feet long which shows signs of continuing west into adjoining property optioned by Fundy Bay. Under an agreement, Cyprus will pay half of the total amount spent to date on development of the property. Trenching, to be carried out jointly by the two firms, will get under way immediately. If mineralization is disclosed, Cyprus will pay the balance of all expenditures to that date and will also fi-



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## INTERNATIONAL

nance a diamond drilling program. Each company will hold 50 percent of the property, but Fundy Bay will option 40 percent of its interest to Cyprus for \$250,000 if Cyprus is satisfied with results. Cyprus will put the property into production if a mine is found and Fundy Bay will then have 30 percent of the company formed to develop and operate the mine.

**BRITISH COLUMBIA**—Diamond drilling is under way on the tungsten and gold-silver property of *Deer Horn Mines Limited* in the Kitimat area. A complete mining plant has been purchased and is now being delivered. Initial drilling is being conducted to further test the important contact zone gold-silver ore structure beginning at a depth of 200 feet where it junctures with the main vein ore zone. Construction work continues on the permanent base camp and road.

**SASKATCHEWAN**—*Meta Uranium Mines* plans underground exploration by means of an adit on the *Tor* property it holds at Murmac Bay on the east side of Beaverlodge Lake. Encouraging results obtained by diamond drilling of 15 holes and deepening of one previously drilled has led to this decision. Meta Uranium is financed by *Consolidated Quebec Gold Mining Corporation* and *National Malartic Mines*.

**OREGON**—*Hanna Nickel Smelting Company* expects to start pouring ferro-nickel from one furnace at its smelting plant near Riddle before September 30 of next year. The remaining three furnaces

will be installed by the end of 1954. Site of the smelter is two miles from Nickel Mountain where Hanna is developing an open-pit mine.

**BRITISH COLUMBIA**—*Sheep Creek Gold Mines, Ltd.* plans to put its new *Mineral King* mine in operation in January. Foundations for a 400-ton concentrator were poured recently at the property in the Invermere district. Most of the milling equipment is being transferred from the company's Zincton, B. C., property which was closed recently. A 1,500-horsepower Diesel electric plant also is being installed. J. R. Pyper of Kamloops has moved up from vice president to president, succeeding A. E. Jukes of Vancouver, now chairman of the board. H. E. Doelle of Nelson, is managing director.

**ALASKA**—*Admiralty-Alaska Gold Mining Company* reports having struck a rich nickel-cobalt-copper vein at Funtier Bay near Juneau. An exploratory drift or tunnel was driven 500 feet into the mountainside to confirm values indicated by previous diamond drilling at the surface. The exploration is being done under a \$112,000 loan from the Defense Minerals Exploration Administration.

**NEW BRUNSWICK**—The site has been cleared and pouring of foundations started for the new mill *Keymet Mines Ltd.* is erecting in the Elm Tree River district near Bathurst. The plant has been designed to handle 150 to 200 tons of lead-zinc ore daily, and is ex-

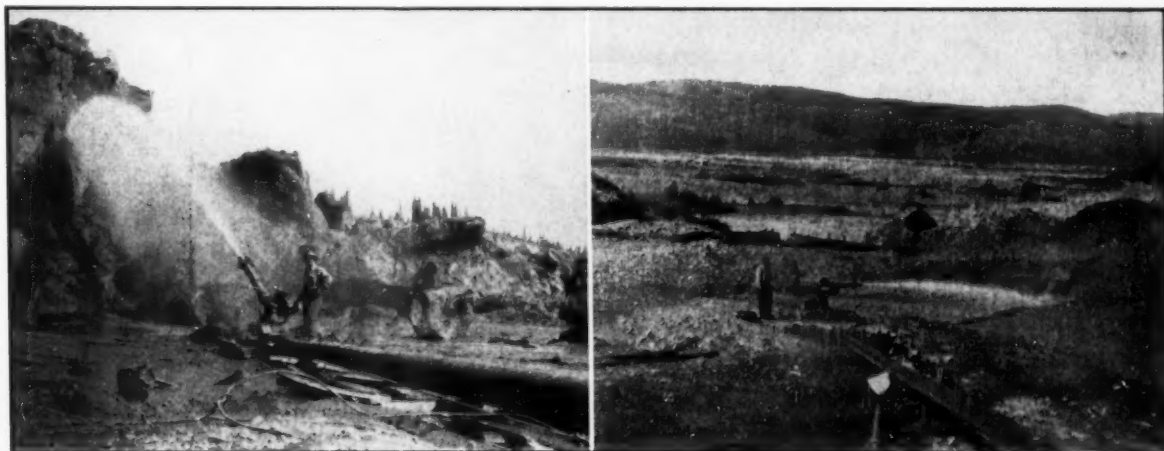
pected to be in operation early next year. Shaft deepening has started to provide two levels at 600 and 750 feet. Some additional lateral work will also be undertaken on the present three levels. Original surface drilling established an ore length of 275 to 300 feet; this has already been extended to over 500 feet on the bottom 450-foot level.

**BRITISH COLUMBIA**—*Kootenay Base Metals, Ltd.* is preparing to resume milling at its *Fort Steele* property. Considerable broken ore is available. *Estrella Mines, Ltd.* has discovered a new high-grade gold-cobalt-uranium zone at its *Little Gem* mine in the Bridge River district.

**ALASKA**—The *Alaska Tin Corporation* has signed a contract with the Defense Minerals Exploration Administration for mineral exploration in the Cape Nome mining district. The government will participate in the \$18,000 contract to the extent of \$16,200.

**NEW MEXICO**—The *Navajo Uranium Division of Kerr-McGee Oil Industries, Inc.* will construct and operate a new uranium ore processing plant at Shiprock, New Mexico, for the United States Atomic Energy Commission. This brings to ten the number of uranium ore processing plants either in operation or under construction in the Colorado Plateau area of the United States. Actual milling of uranium ore is expected to start in 1954.

**BRITISH COLUMBIA**—*Yellow Creek Mica, Ltd.* is diamond drilling a large



### ALASKAN MINER DEVELOPS AUTOMATIC HYDRAULIC GIANT

A fully automatic hydraulic giant for use in placer mining, overburden stripping, and tailing reclamation has been developed by John Miscovich, well-known Alaskan mining man. The Intelligiant is shown in operation in the two pictures above. At the left Mr. Miscovich demonstrates its use in stripping overburden on Cripple Creek near Fairbanks; at the right Sam Markocovich applies it to a sluicing operation on Engineer Creek, also near Fairbanks. The Intelligiant will perform, automatically, any operation feasible with the manual giant. It has self-controlled power regulation secured by utilizing the water pressure in the giant, together with both vertical and horizontal independent power units with individual controls. Other features include: directional speed controls permitting throttling in either direction during either the vertical or horizontal stroke; angular limit stops to control travel to a desired vertical angle or horizontal area; full 320° traverse or any fraction thereof permitting

operation in any area except over the pipeline feeding the giant. Ground sluicing operations are regulated by setting control stops for desired area and vertical angle. By opening of the pressure valve, the motion is started, and by throttling to desired speed, the pattern is set. The Intelligiant follows this pattern as long as there is sufficient water to throw a stream. Ball-bearing joints allow the giant to move freely in any direction and it is also equipped with adequate sealing arrangements to protect bearings against water or grease leakage. It is rugged, compact, and yet light enough to be easily handled by two men. The initial unit operated successfully at 125 pounds per square inch, but plans are under way to increase pressures to as much as 500 pounds per square inch. A set of electrically operated remote controls has been developed to control and operate several giants from a central point.

outcropping of kyanite found 65 miles northwest of Golden by three Spokane, Washington men prospecting along the Big Bend Highway by automobile. The find was made by J. W. Melrose, geologist; C. A. Voight, company president, and Wellman Clark, company secretary. Kyanite showings at the firm's 7,000-foot-high mica property at the head of Yellow Creek, 100 miles northwest of Golden, prompted the search along the Columbia River. The kyanite, which at first glance appears to be mica schist, occurs in a dyke exposed for a length of about 1000 feet and width of more than 55 feet.

**FLORIDA**—The *Coronet Phosphate Company's* holdings in Hillsborough and Polk Counties, Florida, have been purchased by the *Smith-Douglass Company* of Norfolk, Virginia who have now set up a *Coronet Division*. About 12,515

acres are included in the transaction representing 4,116 mineable rock deposits.

**BRITISH COLUMBIA**—The *Western Nickel Mining Company*, with partial financing by the *Newmont Mining Corporation*, is continuing its large exploration and development program at the *Pacific Nickel* mine 12 miles north of Hope, British Columbia. The United States Defense Materials Procurement Agency is committed to furnish half the funds necessary to develop the property for large-scale mining when exploration conditions warrant. The stepped-up program is under the supervision of Barney B. Greenlee, general manager, who recently took charge. He is also the manager of *Resurrection Mining Company*, another Newmont subsidiary, at Leadville, Colorado. Mr. Greenlee will devote most of his time to the *Pacific Nickel* project.

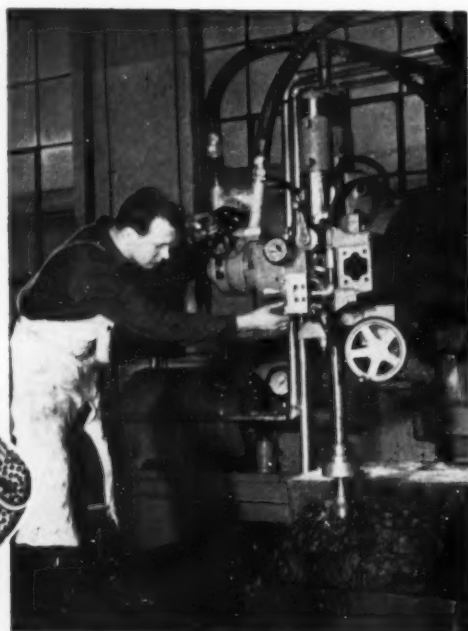


**INDIA**—New drilling equipment has been installed at the *Kandri* mines of the *Central Provinces Manganese Ore Company, Ltd.* to boost production. Operations at the *Chaukhandri* mines of the *Central Provinces Syndiate Ltd.* have progressed well. A strike of high-grade manganese ore appears to have been made, with some of the ore running as high as 60 percent manganese. The company plans to mechanize the mines by procurement of necessary plants and machinery.

**MALAYA**—Production of tin-in-concentrates during the second quarter of 1953 decreased by 563 tons below the production of the previous quarter. One reason for this decline is the drop in the output of the Chinese-operated gravel pump mines. About 54 of these operations are reported to have closed down within the last few months because they have worked out the easily accessible deposits and cannot afford to work the less accessible areas at the current low price of tin. The first half year's output was 27,531 tons, compared with 28,200 tons in the same period of 1952. Production during April, May, and June of this year, according to methods of mining, was as follows: dredging 6,642 tons (49.2 percent); gravel pump 5,418 tons (40.2 percent); hydraulic 280 tons (2.1 percent); open cast 339 tons (2.5 percent); underground 546 tons (4.1 percent); Dulong washing 212 tons (0.3 percent); and miscellaneous 47 tons (1.6 percent). Of the total, European-owned mines produced 7,911 tons (58.67 percent); while the others produced 5,573 tons (41.3 percent).

**JAPAN**—A post-war high of 4,369 tons of primary aluminum was produced by Japanese industry for the month of July. This was an increase of 162 tons over the month of June, and considerably exceeded the target goal of 4,172 tons. In June exports of aluminum amounted to 100 tons, 80 tons of which went to Brazil and 20 tons to Korea. According to the Light Metals Association, 2,600 tons may be exported to Argentina shortly and negotiations are under way.

**INDIA**—Annual production figures for the mining companies operating in the Kolar goldfields are reported below. *Mysore Gold Mining Co. (KGF) Ltd.*—206,172 tons of ore and 857 tons of mill tank cleaning and mill excavation were treated with a recovery of 74,729 fine ounces of gold. *Champion Reef Gold Mines of India (KGF) Ltd.*—148,890 tons of ore were milled with a recovery of 66,477 ounces of gold. Output was seriously affected by rockbursts in Glens ore-shoot and by a fire in the mine which reduced production considerably. *Ooregum Gold Mining Co. of India (KGF) Ltd.*—118,396 tons of ore and 8,794 tons from old dumps which were found to contain gold were milled; 34,600 ounces of gold were obtained. Also 27 tons of the company's ore were treated by the Nundydroog company with a recovery of 21 ounces of gold. As reported previously, the mine will be closed down this year and all leases transferred to the Champion Reef company. *Nundydroog*



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Mines (KGF) Ltd.—228,082 tons of ore milled with a recovery of 65,165 ounces of gold.

**MALAYA**—Pacific Tin Consolidated Corporation reported a net income of \$743,000 for the six-month period ended June 30. Net income for the same period of last year was \$890,000. Sales of tin in the first half of 1953 amounted to 2,157,814 pounds at an average price of \$1.01 per pound, compared with 2,301,882 pounds sold at an average price of \$1.18 per pound during the same period of 1952.

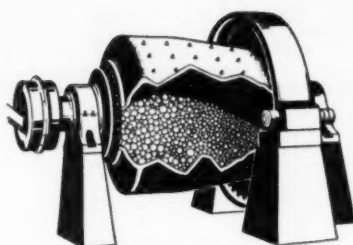
**INDIA**—The Madhya Bharat government has revealed that manganese has been found in various areas of the Nimanpur Forest near Indore. Manganese has been located near Dodra and Canar Rivers in Katkut Forest, and Keria Kund and Polakhali in Nimanpur Forest. The Manganese Mining Corporation of Indore has been licensed to work the Nimanpur Forest area. If this venture is successful, other mining areas will be opened up by the state.

**MALAYA**—Rawang Tin Fields Ltd.'s No. 3 dredge ceased operations when its reserves were depleted recently. Work on dismantling the dredge preparatory to its transfer to the Sungei Kuang area is under way. The No. 2 dredge was dismantled, moved, and re-erected at Sungei Choh earlier this year. For the year ended in March, the dredges worked 7,535 hours treating 3,674,000 cubic yards for a recovery of 800.19 tons of tin concentrate. The company's power station operated throughout the year supplying power to No. 3 dredge, associated mining companies, and the Central Electricity Board. Supply to the Board was discontinued early in January when the new Connaught Bridge Power Station went into operation. No decision has been announced regarding mining leases for land at Bang Toe, Siam.

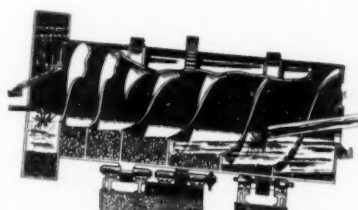
**INDIA**—During the quarter ended March 31, 1953, the Indian Copper Corporation treated 59,719 short tons of ore averaging 2.183 percent copper per ton. Development footage driven during that period was as follows: at the Mosaboni property, 1,240 feet; at the Dhobani property, nil; at the Badia property, 450 feet.

**MALAYA**—More prospecting is being carried on for iron ore by private companies in the Federated States. Pre-war production was almost 2,000,000 tons annually; last year Malayan output was about 1,000,000 tons. Only one big mine, the Bukit Besi in Trengganu, is operating at present. The others have not been reopened since the occupation by Japanese troops during World War II.

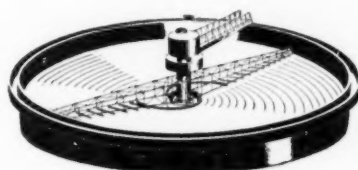
**JAPAN**—Production of electrolytic lead and zinc (electrolytic and retort) reached a record peak for the year with production in July. This was also the highest of the postwar period. Improved domestic markets during recent months account for part of the increase by producers. In addition, leading lead-zinc producers such as Mitsui Mining and Smelting Company, Mitsubishi Mining Company, and Toho Aen Company were hampered in their output by strikes during the first week in June, and some of the tonnages produced by these firms in June were carried forward as July production. Production of copper, lead, and zinc (metal) during July is as follows: electrolytic copper 6,575 metric tons, electrolytic lead 1,908 metric tons, elec-



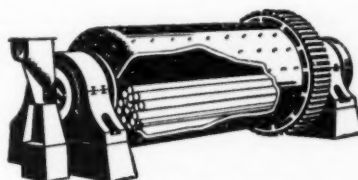
CONICAL AND TRICONE MILLS



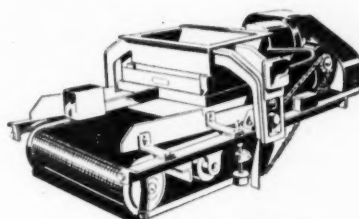
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[World Mining Section—71]

OCTOBER, 1953

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trolytic zinc 5,137 metric tons, retort zinc 1,896 metric tons.

**MALAYA**—Production of scheelite and wolframite during the first half of 1953 amounted to 67 tons.



**EUROPE**

**ITALY**—Quicksilver exports from Italy for the first five months of 1953 totalled 440 tons as compared with 390 tons and 337 tons for the same periods of 1952 and 1951. A low of 49 tons was shipped in April and 72 tons were shipped in May.

**NORWAY**—Annual production of 40,000 tons of aluminum will start next year at Norway's biggest aluminum plant at Sunndalsora in west Norway. Production may eventually be increased to 50,000 tons and since Norway's production of aluminum at present is already about 50,000 tons per year, the new plant is expected to double the national output. The plant is being built with aid of a United States loan to be repaid from aluminum production at the rate of about 8,000 tons a year. The *Ardal Aluminum Company* which now operates an aluminum plant at Ardal in west Norway will also be in charge of this project. Production facilities will be housed in two buildings, each 1,600 feet long, holding 264 furnaces. About 1,000 workers will be employed when production starts.

**ENGLAND**—Imperial Chemical Industries (ICI) is constructing facilities for producing 1,500 tons of sponge titanium and for converting the metal into ingot form. The proposed plants are in addition to the pilot plants now under construction and are expected to be in production within two years. The pilot plants are scheduled to start producing next year. Plans for the new plants apparently are based on a new and more efficient process than previously used. The Ministry of Material has contracted to buy directly up to three-quarters of the company's output of sponge titanium for the first four years of production provided the metal is not otherwise sold in various forms for use by government contractors. The Ministry also has an option on the full output if needed for defense purposes. The price of the metal will be equivalent to the prevailing world price at the time of purchase.

**WALES**—A lead deposit at Llanwrst, North Wales, reportedly has been reopened and is now producing about 200 tons of lead-zinc ore per day. Reserves are estimated at about 450,000 tons. Electric pumps and conveyors have been installed at the mine to develop veins below the water level. Diamond drilling was started in 1951. The mine employs 120 men at the present time. Selective flotation produces a lead concentrate taken to Chester for smelting and a zinc concentrate shipped to Avonmouth. There is speculation that the reconditioning of this abandoned mine may prove the first of many similar ventures.

**RUSSIA**—According to figures presented to the Supreme Soviet by Premier Georgi M. Malenkov, steel production in the Soviet Union will be 38,000,000 tons this year and will increase to



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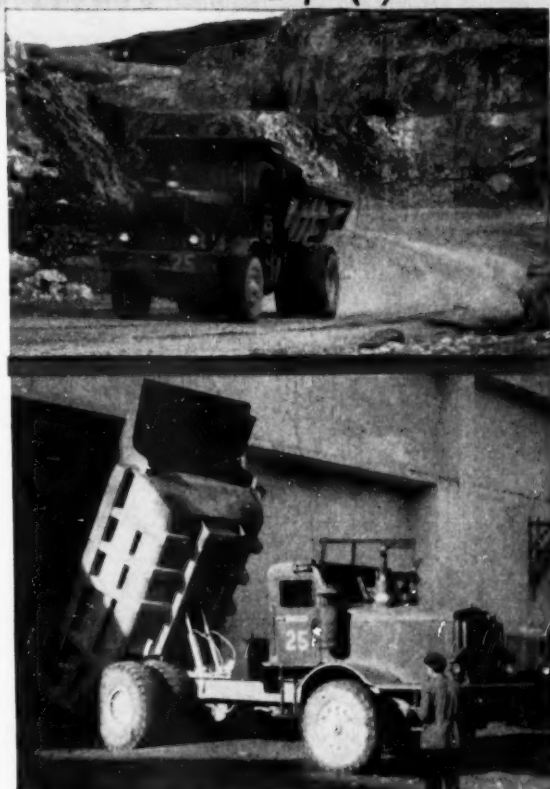
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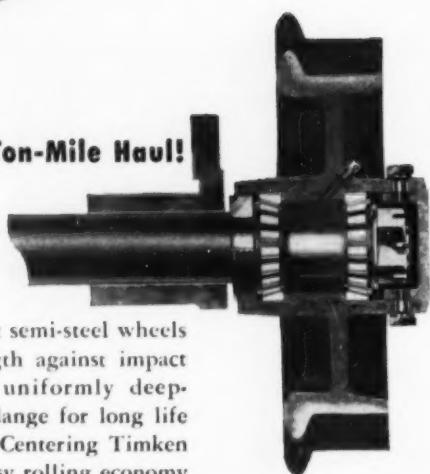
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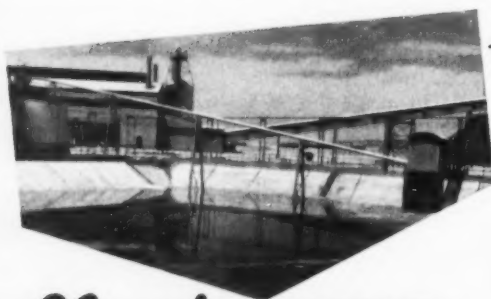
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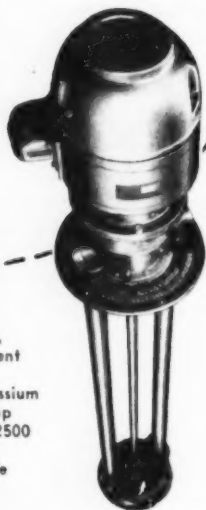
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44,700,000 tons by 1955. In a recent speech, Premier Malenkov stated that production was 27,600,000 tons in 1950 and 35,000,000 tons last year. According to latest reports, Poland, Czechoslovakia, Hungary, and Rumania produced an added 9,000,000 tons of steel last year to raise the total available to the Soviets to 44,000,000 tons. If reports are accurate, Russia has more than doubled her steel output since 1940. The Soviet Premier also announced that coal output rose from 166,000,000 metric tons in 1940 to 300,000,000 metric tons last year and is scheduled to rise to 375,000,000 tons in 1955. Similarly, electric power output was 48,000,000,000 kilowatts in 1940, 117,000,000,000 last year, and is expected to be 133,000,000,000 this year and 162,000,000,000 in 1955.

**AUSTRIA**—Austrian aluminum export reached 11,980 metric tons during the first five months of 1953 as against a total of 15,290 metric tons during the entire year of 1952. The Austrian aluminum industry achieved an output 833.5 percent greater than that of 1938.

**POLAND**—The output of the Polish non-ferrous ore industry was three percent above the production plan if the report of the Statistical Office of the Polish government is correct. During the first quarter of 1953, the Polish industry reported a four percent surplus production of ore mined.

**GREECE**—The firm of *Fried. Krupp* of Essen, Germany will build metallurgical and ore dressing plants to treat nickel ore mined near Larymna, Greece. Under terms of the contract, Krupp will buy part of the nickel produced. About 130,000 tons of nickel ore will be treated yearly at the new plant which is expected to be finished by the end of 1954. *Stahlbau Rheinhausen* and *Essener Maschinenbau*, formerly owned by the Krupp combine, will deliver furnaces and heavy machinery to the plant. Total value of the completed project is expected to be more than £935,000.

**ENGLAND**—During the past few months, the fall in metal prices has caused some concern, especially the heavy drop in tin prices. The situation has improved slightly since the end of July, however. Both of the larger tin mines in Cornwall continue to maintain output. The *Geveor Tin Mines, Ltd.* reports an operating profit before taxation and appropriation of £115,462 compared with £222,825 last year. Total tonnage milled amounted to 57,368 tons yielding 600 tons of tin concentrate (65 percent Sn) equal to an average recovery of 23.43 pounds per ton of ore milled. Development at 6,702 feet exceeded that for the previous year by 681 feet; ore reserves are unchanged. A new compressor house has been completed; a new compressor and two old units have been housed in it and are in operation. Foundations for the new hoist are now finished and it is hoped that it will be installed and the new headframe erected by the end of the year.

**AUSTRIA**—The *Styrian Alpine Mountain A.G.* has recorded a peak production of ore mined at Ore Mountain in Styria during June 1953. The total was 225,660 metric tons, or 4,000 tons less than the all-time-high monthly production achieved during 1940 (under German management). The company's other mines, at Radner and Huetteneberg, yielded 15,380 and 16,600 metric tons respectively during June. The production of pig iron reached 39,800 tons during June. Steel production reached an all-time high of 51,254 metric tons.

## INTERNATIONAL

**CZECHOSLOVAKIA**—The Czech mining industry fulfilled 99 percent of its production plan for the second quarter of 1953. Iron ore and manganese ore production lagged. During the first quarter of 1953, only 95.4 percent of the government's production plan was fulfilled.

**AUSTRIA**—June production of Austrian ores is officially listed as follows: iron ore, 257,640 tons; copper ore, 13,389 tons; antimony ore, 747 tons; graphite, 977 tons; magnesite, 71,326 tons; lead-zinc ore, 10,955 tons; sulphur ore, none; bauxite, 1,010 tons; gypsum, 26,634 tons; and kaolin 16,318 tons. Production of pig iron during June amounted to 113,297 metric tons. Steel reached a production level of 101,769 metric tons.

**ENGLAND**—A trial run at the Ministry of Supply's large wolframite recovery plant at Hermerdon, shut down since the end of the war, took place in July. Some experimental washing prior to treatment was carried out because the clay in the ore had caused trouble during previous milling operations.

**PORTUGAL**—Large deposits of hematite at Moncorvo in North Portugal are supplying increasing quantities of ore to European steel manufacturing centers, mainly in England, Germany, and Italy. During 1952, shipments amounted to 85,000 tons. This year, through July, 81,000 tons were shipped. Total exports in 1953 are expected to reach about 150,000 tons. Certain and probable reserves at Moncorvo are estimated at about 400,000,000 tons with an iron content of about 50 percent. These deposits are the main sources for the raw materials on which plans are based for the establishment of a Portuguese iron and steel industry. Under the present six-year development plan, the industry will be started in the near future with state help. No final plans have been agreed upon as yet.

**ENGLAND**—London metal brokers will soon campaign for wider use of the London market by British and Continental merchants. Good trade conditions in Britain and monthly export increases are credited for the firmness of metal prices on the London Exchange. Production for the home market is above last year's level, and exports, especially to the United States, are better than they have been before. However, the London market is not yet as large as before the war. Tin turnover this year has averaged 25,000 tons a month, about the same as in 1938. Lead turnover has averaged 20,400 tons a month, compared with 32,300 tons in 1938. Zinc turnover is 18,700 tons compared with 24,500 in 1938.

**NORWAY**—*Folldal Verk* is mining copper ore deposits found at Grimsdal in Folldal, southeast Norway. At least 1,000,000 tons of copper ore are estimated to be on hand. The company has also explored some deposits at Soendre Geitryggen which have been proved to contain only about 400,000 tons. Geophysical measurements indicate that other deposits may be found in the same area, however, and these will be explored later.

**HUNGARY**—The *Sztalinvaros Steel Combine* has completed a new bridge-crane system over the iron ore stockpiling pits of the *Stalin City* mine to assure a steady flow of sorted ore to the blast furnaces of this enterprise.

OCTOBER, 1953



**NYASALAND**—*General Refractories Ltd.* has undertaken an extensive geological survey of the kyanite ( $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ ) deposits at N'cheu, and a diamond drilling program is being started soon. The company's kyanite quarry is at present producing 200 tons of crude, massive ore weekly, which is being shipped directly to the Sheffield steel works in England for calcination. The kyanite ore is of excellent quality and assays 63 percent  $\text{Al}_2\text{O}_3$ .

**SOUTHERN RHODESIA**—A pollucite deposit has been discovered on the *Nigel Valley* claims in the *Bikita* tin fields of the Fort Victoria district. Pollucite ( $\text{CsSi}_2\text{AlO}_6$ ) is an important and rare caesium ore. It occurs here associated with petalite ( $\text{LiSi}_2\text{AlO}_6$ ), a lithium ore, which is now being mined in the Victoria district and largely exported to the United States. The production of pollucite has already started at the Nigel Valley mine.

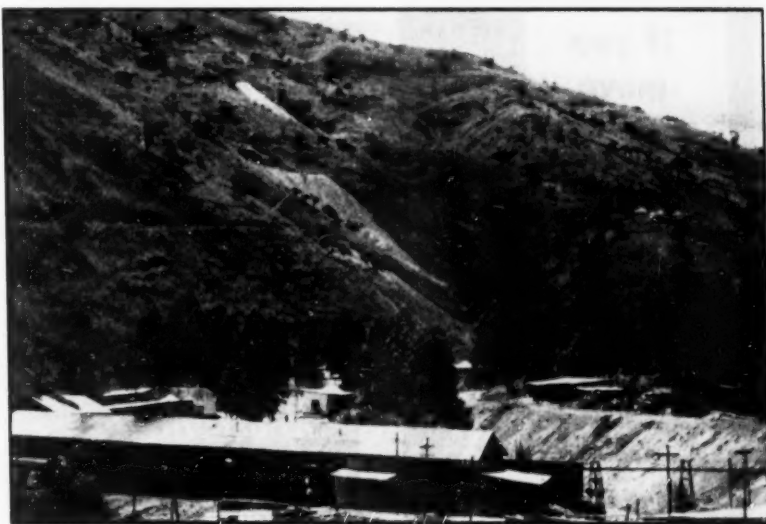
**EGYPT**—The *Ras Mallap Mining Company, S.A.E.* has resumed gypsum production at a rate of 6,000 tons per month from the quarry at Waadi Gharandel in the Eastern Desert along the shores of the Red Sea. The crude rock is transported by Diesel locomotives from the quarry to the Ras Mallap Bay, four miles away, where 30,000 tons of gypsum have been stockpiled for export to the Far East. Plans are being investigated to raise monthly production to 50,000 tons. Also under consid-

eration is installation of a giant conveyor belt for direct loading into ocean-going vessels from the gypsum range in the company's northern concession. A recent geological survey of this area confirmed existence of a 12-kilometer-long gypsum range of low-lying hills barely 1,000 feet from the shore of the Red Sea.

**BELGIAN CONGO**—During the month of June 1953, production from the *Societe des Mines d'Or de Kilo Moto* totaled 656,184 grams of fine gold compared with 579,913 grams in May. For the first six months of the year, production was 3,769,274 grams, compared with 3,898,289 grams for the same period of 1952.

**UNION OF SOUTH AFRICA**—At the *Rustenburg* chrome mine of the *South African Minerals Corporation*, ore output has been increased and production of concentrates started. Shipments were again restricted by lack of rail transportation to Lourenco Marques Mozambique. Chrome ore shipments for the quarter ended June 30 were 6,021 long tons. In the first quarter of the year, chrome shipments were 10,866 long tons.

**SOUTHERN RHODESIA**—An exclusive prospecting reservation of 50 square miles has been made in the Bukwe Hill area, Belingwe, following an application to the Mines Affairs Board by the *Messina (Transvaal) Development Co., Ltd.* The area embodies the extensive *Bukwe Hill* iron ore deposits which, until now, have been unmined because of the distance from the railroad. The new rail link between Bannockburn and Pafuri (Mozambique) now under construction, will divert part of Rhodesia's base metal exports to the Port of Lourenco Marques and will also place these Bukwe Hill deposits with-



### KILEMBE'S COPPER-COBALT MINE

A part of the mine workings at the Kilembe copper-cobalt mine in western Uganda, Africa, are shown in the photograph above. The mineralized zone can be traced from the lower workings by the two dumps on the hillside. Development by Kilembe Mines Ltd., a subsidiary of Frobisher, Ltd., has indicated more than 4,000,000 tons of ore with a grade of 2.05 percent copper and 0.171 percent cobalt. Inferred and indicated reserves are in excess of 10,000,000 tons of comparable grade material. Plans are under way to erect a concentration plant for sulphide ore. The oxides will be mixed with concentrate and treated in a Dorr Fluosolids roaster, calcines leached, and copper and cobalt recovered by electrolysis.

[World Mining Section—75]



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in a few miles of the nearest railroad. Should the exploration program prove sufficient ore, the basis for a new iron and steel industry might be provided in conjunction with the nearby Sabi Valley coal-fields.

**MOZAMBIQUE**—A pilot plant has been erected at Inchope in the tin fields owned by the *Sociedade Mineira do Inchope*. These are located a few miles south of the Beira (Port)-Umtali (Southern Rhodesia) railway line. The ore is derived from greisen zones containing from 1.0 to 4.0 percent tin, accompanied by a small percentage of columbite which is a byproduct. The Inchope tin fields have produced small amounts of cassiterite concentrates spasmodically during the last few years. The ore was derived mostly from rich alluvial placers worked on a modest scale by small operators because of the scarcity of water in the area. This new plant is the first to treat greisen ore in Mozambique.

**SOUTH WEST AFRICA**—South African Minerals Corporation's prospecting rights to 350 square miles in South West Africa have been extended to August 30, 1954. Prospecting and diamond drilling are continuing in this area and on other holdings of the company. For the quarter ended June 30, 15,402 long tons of manganese ore were shipped realizing £214,000 on a basis of 48 percent Mn. Current shipment prices range up to £17 1/2 f.o.b. long ton, Walvis Bay. Pumping equipment is being installed by S.A. Minerals to dewater one of the shafts at the nickel deposits it is currently investigating. Samples will be sent overseas for assaying and testing.

**GOLD COAST**—A group of engineers and mining men have been sent to Canada to inspect aluminum and power installations so that they may obtain first-hand information which will assist them in the Volta River hydro-electric project which has been under discussion for some time on the Gold Coast. The *Aluminum Company (British)* and the *Aluminum Company of Canada* have a part in the program which aims to make the Gold Coast one of the world's largest producers of aluminum.

**ALGERIA**—The *Mines de Sidi Kamber* will receive a loan of 238,000,000 francs from the United States Defense Materials Procurement Agency to assist in the development of lead ore in Algeria. The French government has approved the contract which provides for repayment of the loan in ore shipments to the U. S. stockpile.

**FRENCH WEST AFRICA**—A new company, the *Company for Mineral Study*

and Research for Senegal (S.E.R.M.I.S.), is evaluating a calcium phosphate deposit located near Tivavouane. The formation assays from 60 to 72 percent P<sub>2</sub>O<sub>5</sub> and is believed capable of having an annual production of from 300,000 to 500,000 tons of ore for several years.

**GOLD COAST—Taquah & Abosso Mines Ltd.** reports that for the quarter ended June 30, a total of 630 feet had been developed, including 177 feet of drifting and 453 feet of raising, 110 feet of drift sampled assayed 7.19 dwt. per short ton over a width of 60 inches; in raises, 250 feet sampled assayed 6.11 dwt. per short ton over a width of 41 inches.

**SIERRA LEONE**—The Minister of Mines, Labor and Lands, Siaka Stevens, is in London negotiating with the *Sierra Leone Selection Trust*, the company which holds the exclusive diamond mining rights in Sierra Leone. Mr. Stevens is seeking increased financial benefits for Sierra Leone from the diamond mining industry. Unlike the Gold Coast where native citizens mine diamonds on the concession, this privilege cannot be granted in Sierra Leone until the ordinance giving exclusive rights to one mining firm is repealed or alternative arrangements made.

**SOUTHERN RHODESIA**—The *Messina (Transvaal) Development Co., Ltd.* which operates a large copper mine in Northern Transvaal (South Africa) has recently purchased the *Umkondo* mine in Rhodesia from the *Union & Rhodesian Mining and Finance Company, Ltd.* This mine is situated in the Sabi Valley and was developed on a small scale during 1903 to 1908 on two narrow copper-bearing shale beds containing 8.0 percent copper. A concentrating plant is now to be erected on this property and the mine is being reopened.

**GOLD COAST—Konongo Gold Mines Ltd.** completed 1,259 feet of development work in the quarter ended June 30. 1,053 feet of this was drifting, 174 feet was crosscutting, 25 feet was winzing, and 7 feet was excavating. On No. 9 level Zongo, a winze to No. 10 level was sunk 25 feet. On No. 15 level Odumase, a N.E. drive advanced 278 feet and is expected to intersect the Boabedroo ores shoot some 1,800 to 2,000 feet ahead. On the No. 11 level Boabedroo, the south drive in the hanging wall over a length of 125 feet averaged 19 dwt. across a width of 59 inches. On No. 12 level, No. 12 stope drive was advanced 288 feet to 446 feet, the latter 115 feet assaying 8.5 dwt. over 78 inches. Three bore holes to test the Odumase Reef 300 feet below No. 20 level intersected the fissure but did not disclose payable reef.

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Take any *straight-sided* V-Belt (Fig. 1) and bend it as it bends in going around its pulley. At the same time, grip its sides with your fingers and *feel* those sides *bulge out* as in Fig. 1-A.

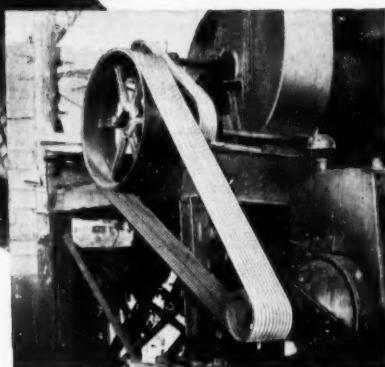
Clearly, those bulging sides will press *unevenly* against the V-pulley—and this causes extra wear at the points shown by the arrows (Fig 1-A).



## Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)

As the belt bends, grip its sides—and you will feel the precisely engineered CONCAVE SIDES *fill out* to an *exact fit* in the sheave groove (Fig. 2-A).

These sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the full width of the Gates Vulco Rope—and this means *longer* belt life and *lower* belt costs for you!



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# Tanganyika Mineral Exports January to June 1952 and 1953

Minerals	January 1952	June 1953
Diamonds <sup>1</sup>	\$4,405.07	48,300.
Gold (refined) <sup>2</sup>	\$4,145.705	32,108.270
Graphite <sup>3</sup>	25.00	—
Kaolin <sup>4</sup>	375.99	45.16
Lead conc. <sup>2</sup>	2,817.96	1,726.80
Lime <sup>2</sup>	120.00	120.00
Magnetite <sup>2</sup>	100.00	—
Mica <sup>2</sup>	—	—
Sheet	40.10	40.63
Waste	51.00	—
Silver (refined) <sup>2</sup>	18,982.78	17,800.56
Tin conc. <sup>2</sup>	43.65	26.43
Tungsten conc. <sup>2</sup>	15.10	10.18

1. carats 2. ounces 3. long tons 4. metric tons

**NORTHERN RHODESIA**—The recent discovery of disseminated pyrochlore deposits made in the Nkumbwa Hill area in the northern province has shown 73.46 percent of combined oxides of columbium and tantalum. The area has been closed

for prospecting pending extensive field surveys at present being carried out by the Northern Rhodesian Geological Survey.

**UNION OF SOUTH AFRICA**—Under an agreement with Anglo American Corporation of South Africa Ltd., Selection Trust Ltd. has acquired a substantial shareholding in Vaal Reefs Exploration and Mining Co., Ltd. Vaal Reefs is opening up its mining lease area immediately east of the Western Reefs mine. Development on the Vaal Reef horizon is now being advanced from No. 3 Sub-Vertical Shaft which was jointly sunk with the Western Exploration and Development Company, Ltd. Also in progress is development work—cutting the station and transfer system and excavating for hoists and other shaft equipment—preparatory to the sinking of the No. 1 Sub-Vertical Shaft from a drive advanced from the No. 3 shaft. The latter is on the common boundary with Western Reefs, and the site of the No. 1 shaft is about 8,500 feet northeast of the No. 3 shaft.

**SOUTHERN RHODESIA**—A dozen asbestos mines are reported to have closed in the last few months, with others temporarily stopping production or facing the prospect of closing. The main reason is said to be that overseas buyers are refusing to accept ungraded asbestos and most, if not all, asbestos from these mines is ungraded or not properly graded. One solution offered is the setting up of grading plants through which all asbestos would pass for grading under government supervision.

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**LATIN AMERICA**

**MEXICO**—The Continental Mineral Company, S.A. is conducting development work at the El Canutillo group of claims in Sonora, Mexico. During both World Wars, the El Canutillo furnished small tonnages of high-grade molybdenite to the Allies. Latest development indicates the possibility of developing the mine into a medium-sized operation with ore approximating 1.50 percent MoS<sub>2</sub>. During previous operations, Canutillo furnished mill heads averaging better than 8.00 percent MoS<sub>2</sub>. Frederick Hauck of Cincinnati, Ohio is president of Continental, and H. R. Herner of Douglas, Arizona is manager of Mexican operations. Continental also owns the Verde group of claims and the Cobre Rico mine located near Cumpas, Sonora, Mexico.

**FRENCH GUIANA**—Outcroppings of hematite have been surveyed on several 10-kilometer strips at several points on a line which seems to parallel the coast at a minimum distance from Cayenne of 30 kilometers. The high quality of the ore and the generally favorable geographic situation justify the investigations which are going to be made by the Guiana Bureau of Mines. These will seek to prove the existence of a bed of hematite in spite of the topographical difficulties of the region.

**ARGENTINA**—Several investigations are under way which may lead to the development of the iron-titaniferous deposits forming dunes (eolian origin) on the Atlantic shore of the Buenos Aires province. Geologists believe that the oc-

currence may contain 2,000,000 tons assaying 0.3 to 1.0 percent of TiO<sub>2</sub>.

**MEXICO**—A germanium deposit is reportedly being investigated by the National Institute for the Investigation of Mineral Resources in the area around Oaxaca City, Oaxaca. The Institute is also examining reported uranium discoveries in Oaxaca mostly in the zone of the Isthmus of Tehuantepec.

**COLOMBIA**—During the six months ended June 30, Asnazu Gold Dredging, Limited dredged 3,241,600 yards to recover 8,714 ounces of fine gold; Nechi Consolidated Dredging Limited dredged 2,025,000 yards to recover 7,606 ounces of fine gold; and Pato Consolidated Gold Dredging, Limited dredged 8,227,700 yards to recover 78,872 ounces of fine gold. Asnazu reports that its dredge No. 2 has been closed down and is being dismantled. Previously it had been planned to operate the dredge at a profit until April 1954, with the assistance of the gold bonus. However, the government was taken over by General Rojas Pinilla in mid-July who immediately established a free gold market, thereby automatically terminating the gold bonus. Profitable operations of the dredge could not be continued under these conditions.

**PERU**—Consolidated Guayana Mines, Ltd. has established a branch office in Lima to examine properties on the west coast of South America. The company holds a 25 percent interest in Chavin Mines Corporation. The remaining 75 percent interest has been purchased by Frohisher Ltd. A new exploration program is now underway by the two groups to thoroughly appraise the entire area. One vein which outcrops over a length of 2,000 feet has been located near the mine and this is now being drilled. In the mine about 300,000 tons of high-grade lead-zinc ore have been developed. The ore is said to carry about 25 percent combined lead and zinc, with 2 percent copper and 4 ounces silver per ton. Horizontal and vertical work is being pushed.

**ARGENTINA**—According to recent reports, the national government is considering carrying on mining exploration in the district of Hualfin, province of Catamarca, where it is claimed that important gold ores exist. The Farellon Negro mine is in this locality.

**MEXICO**—At the Los Alamos tungsten property near Alamos, Sonora, Mexico, Consolidated Guayana Mines Ltd. has set up a small mining plant which operated continuously until May of this year. Development work at the property has included 1,564 feet of tunneling and 176 feet of raising. Work is on a stand-by basis at present pending outcome of metallurgical tests being made on a 25-ton bulk shipment to Quebec Metallurgical Industries' laboratories at Ottawa, Ontario.

**BOLIVIA**—Technicians are reported to have confirmed the presence of columbite, monazite, and fluor spar in the districts of Santa Cruz and Cochabamba. It is also reported that the Amazonia Foundation is investing a substantial sum for the examination of the columbite deposits.

**MEXICO**—The important lead-zinc mining belt of Toliman Canyon, Nuevo Leon, is expected to become even more important with the opening of the new 12-mile road currently being constructed by the state and federal governments.

The road extends from the Canyon, where 24 mines are working, to Zimapan on the Mexico, D.F.-Laredo, Texas highway, a branch of the Pan American Highway.

**ARGENTINA**—A deposit of alunite [ $KAl_2(OH)_2(SO_4)_2$ ] found in Camarones, Comodor Rivadavia territory, has been described as very extensive. A recent mineralogical report reveals encouraging results regarding the possibility of profitable alumina production.

**FRENCH GUIANA**—A great tonnage of bauxite has been noted in the massif of Kaw. The surveys will be completed this year. Various indications of layers of bauxite are being investigated in the region of Saint-Laurent-Mana, along the Moroni, and on the Approuague.

**MEXICO**—The Korean Armistice is reported to have seriously affected an important branch of the Mexican mining industry. Sudden suspension of work at the *San Joaquin, El Zoyatal, La Esmeralda, El Serrano, El Danto Entierro, La Concha, and Pinal de Amoles* antimony mines in the El Zoyatal municipality of Queretaro is said to be directly attributable to suspension of hostilities in Korea. Operators of these mines are reported to be limiting themselves to sales of the stock on hand. About 1,500 workers have been affected by this cessation in production.

**FRENCH GUIANA**—In the Saul region, the Boeuf-Mort vein has been located. Initial sampling and assaying have been satisfactory. Another year of work is still necessary in order to complete the prospecting and evaluation. On the middle Mana, control of the prospecting will be under the direction of a geologist with work expected to start shortly. Mining will be by dredge, and prospects are considered to be very favorable. The *Saint-Elie and Adieu-Vat Company* has presented a two-year program for prospecting of its mining areas with a maximum expenditure of 99,000,000 francs. The Guiana Bureau of Mines has agreed to advance two-thirds of the sum, reserving for itself the right of reimbursement from the stock of the company. The operations will be supervised by a committee composed of two representatives of the Guiana Bureau of Mines, one representative of the Central Bank of France for Overseas, and one representative of the company.

**VENEZUELA**—A completely equipped laboratory has been designed by *Sam Tour & Co., Inc.* to handle analytical and assay work at the newly developed iron mine of the *Orinoco Mining Company* at Cerro Bolivar. The lab has been designed to operate six months without additional supplies if necessary because the mine is too remote to receive frequent supply deliveries. Methods and procedures for analyses of such things as iron, silica, alumina, phosphorus, manganese, titanium, moisture, and organic materials were also outlined by the consulting firm. Nearly 200 samples will be analyzed daily during two eight-hour shifts.

**BRAZIL**—Overseas inquiries are being made regarding the purchase of iron ore from the *Vale do Rio Doce* deposits. Two Iron Curtain countries, Poland and Czechoslovakia, are said to be in this group of interested purchasers. Offers are reported to be in the neighborhood of \$18.00 (U.S.) per long ton; recent shipments of ore from these deposits to the United States have been at \$13.50 per long ton.

OCTOBER, 1953

THE SUN NEVER SETS...



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8. Rugged steel chuck with extra long jaws.
9. Two stabilizing jacks.
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11. Uses any standard diamond drill tools and bits.
12. Maximum depth 300 feet—E size tools.

**The New Model TS Acker Screw Feed Diamond Bit Drill**

Here's the latest Acker Time-saving screw feed diamond drill. Ready for action anywhere a Jeep can go. The entire unit is self-contained with power take-off directly from a Jeep or small truck. The extreme portability of Jeep mounting speeds diamond drilling over the roughest terrain.

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Manufacturers of a complete line of Diamond and Shot Core Drills, Drilling Accessories and Equipment

[World Mining Section—79]





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TO APPLY IT**

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**CRESCENT Buckets**  
1/3 to 15 cu. yd.

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Above picture shows a Sauerman Scraper machine with movable tail tower designed for stocking out and reclaiming large tonnages at a rapid rate. This is one of six basic types of Sauerman stockpiling machines.

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## ENGINEERING BOOKS:

### Views and Reviews

**AN OUTLINE OF METALLURGICAL PRACTICE, III**  
Edition. By Carle R. Hayward, D. Van Nostrand Company, Inc. New York, New York. 1951, 728 pp., 65 tables and more than 400 illustrations. \$10.00

This new and up-to-date basic reference work and textbook on nearly all metals covers essential facts about metallurgical practice from mine to finished product. Many sections were completely rewritten due to progress made in the industry. New ones have been added to cover the numerous recent developments.

An increasing interest in titanium and uranium has caused the inclusion of brief chapters on these metals and the treatment of secondary metals reflects their increasing importance.

Carle R. Hayward, Professor Emeritus of Process Metallurgy at Massachusetts Institute of Technology is a consulting metallurgist as well as a member of the Board of Directors of Metal Hydrides, Inc., in Beverly, Massachusetts. As part of his preparation for writing this book he made an extended inspection trip to typical metallurgical plants whose facilities were placed at his disposal. This present volume is sponsored by the American Smelting and Refining Company.

**THE HISTORY OF FIFTY YEARS OF MINING AT TONOPAH, 1900-1950.** By Jay A. Carpenter, Russell Richard Elliott, and Byrd Fanita Wall Sawyer. University of Nevada Bulletin, Vol. XLVII, No. 1, January 1953, 13 illustrations, 157 pp., \$1.00.

Anyone interested in Nevada mining will find the bulletin packed with the thrilling story of the fabulous old Nevada silver camp, stated with authenticity, for at least one of the authors—Jay Carpenter—went into Tonopah a few years after its discovery. Carpenter got much of his mining experience, immediately after graduating from the University of Nevada, in that camp and took a prominent part in its development and growth.

Carpenter wrote his 110-page part of the bulletin from actual experiences and from innumerable records which he had gathered concerning the many mining companies operating at Tonopah. This was done over a period of many years. It was compiled and eventually conditioned for the present bulletin, which goes into great detail concerning the various periods of the camp's life.

Mining history of Tonopah is chronologically written, covering four distinct periods in the economic life of the camp. The first was the early boom days from discovery to 1907; the second involved a recession in 1910; the third shows two decades of great production; and the fourth sadly notes two decades of decline to 1950.

In each period, the individual history of each large mining company is given. Company officials are named; assessments of the various companies are listed; dividends noted; and even the profits which were deflected to the search for additional properties are enumerated. Engineers who participated in the development and operators and managers who directed the course of the mines are also designated, and the important part they played in developing Tonopah to its peak time of glory. There is a wealth of interesting material embraced within the pages of this remarkable work.

Copies of any of these books may be purchased from Mining World, 121 Second Street, San Francisco.



# U.S.A. Metal & Mineral Prices

## METALS

September 25, 1953

COPPER:	Electrolytic, Delivered F.o.b. cars, Valley basis .....	28.50-30.00¢
	Lake, Delivered, destination U.S.A. ....	30.125¢
	Foreign Copper, Valley basis .....	28.50-30.00¢
LEAD:	Common Grade, New York .....	13.50¢
	Tri-State Concentrates, jig, flotation 80% lead, per ton .....	\$166.50
ZINC:	Prime Western; F.o.b., E. St. Louis .....	10.00¢
	Prime Western; Delivered, New York .....	10.50¢
	Tri-State Concentrate, 60% zinc, per ton .....	\$56.00
ALUMINUM:	Primary 30 Pound Ingots (90% plus), F.o.b. shipping points .....	21.50¢
ANTIMONY:	Lane Star Brand, F.o.b. Laredo, in bulk .....	35.00¢
BISMUTH:	(in ton lots) price per pound .....	\$2.25
CADMIUM:	Sticks and bars, 1 to 5 ton lots (Price per pound) .....	\$2.00
COBALT:	97-99%, keg of 550 pounds (Price per pound) .....	\$2.40
MAGNESIUM:	Ingots (99.8%), F.o.b. Freeport, Texas .....	\$187.00
MERCURY:	Fasks, Small lots, New York .....	197.00¢
NICKEL:	"F" Ingots (5 pounds), F.o.b. refinery, Port Colborne, Ontario .....	60.00¢
TIN:	Grade A Brands, New York (Price per pound) Prompt delivery .....	81.50¢
TITANIUM:	99.3% + (Price per pound) .....	\$5.00
GOLD:	United States Treasury price .....	\$35.00 per ounce
SILVER:	Newly mined domestic, United States Treasury price .....	90 1/2¢ per ounce
	Foreign Handy & Harman .....	85.25¢ per ounce
PLATINUM:	.....	\$93.00 per ounce
ZIRCONIUM:	Powder, 100 pound lots, per pound .....	\$7.00

## ORES AND CONCENTRATES

BERYLLIUM ORE:	10 to 12% BeO, F.o.b. mine, Colorado .....	\$45.00 per unit
	Small lot purchases at Custer, S. D., Spruce Pine, N. C. and Franklin, N. H. Visual inspection at \$400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$50.	
CHROME ORE:	F.o.b. railroad cars eastern seaports, Long tons dry weight.	
	African (Rhodesian), 48% Cr <sub>2</sub> O <sub>3</sub> , 3 to 1 Ratio .....	\$44.00-\$46.00
	African (Transvaal), 48% Cr <sub>2</sub> O <sub>3</sub> , No Ratio .....	\$34.00-\$35.00
	Turkish, 48% Cr <sub>2</sub> O <sub>3</sub> , 3 to 1 chrome-iron ratio .....	\$54.00-\$56.00
	U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, \$115.00; fines and concentrates \$110.00 for 48% Cr <sub>2</sub> O <sub>3</sub> and a 3 to 1 chromium-iron ratio. Premiums for higher grade ore and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr <sub>2</sub> O <sub>3</sub> .	
COLUMBIUM-TANTALUM ORE:	At United States small lot beryl purchase depots, \$3.40 per pound contained combined pentoxides in 50% ore.	
IRON ORE:	Lake Superior, Per gross ton Lower Lake Ports.	
	Mesabi, Non Bessemer, 51.5% Fe, Second quarter .....	\$9.90
	Mesabi, Bessemer, 51.5% Fe, Second quarter .....	\$10.95
	Old Range Non Bessemer, Second quarter .....	\$10.15
	Old Range Bessemer, Second quarter .....	\$10.30
	Swedish, Atlantic Ports, 60 to 68% Fe, Contracts, Per Unit .....	20.00¢
MANGANESE ORE:	Metallurgical grade, 46 to 48% Mn, Long ton unit .....	\$1.15-\$1.17
	Chemical grade, 80% MnO <sub>2</sub> , Per ton .....	\$70.00
	Domestic U. S. Government ore purchasing depots: Deming, New Mexico; base price \$2.30 per long dry ton unit for recoverable manganese less handling and treatment costs. Wendon, Arizona; base price of \$8.54 per long dry ton of 15% manganese ore, Butte, Montana; (black and pink ores) base price of \$4.87 per long dry ton of 18% manganese ore. Phillipsburg, Montana base price of \$6.43 per long dry ton unit of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) \$2.30 per unit with premiums and penalties.	
MOLYBDENUM CONCENTRATE:	90% MoS <sub>2</sub> , F.o.b. Climax, Colorado, Per pound of contained molybdenum, plus cost of containers .....	\$1.00
TUNGSTEN CONCENTRATE:	Domestic, 60% WO <sub>3</sub> , Per short ton unit .....	\$65.00
URANIUM ORE:	Foreign, 65% WO <sub>3</sub> , Per short ton unit .....	\$50.00
	Carnotite-Roscoelite, F.o.b. purchase depot plus \$0.06 per ton mile (\$6.00 maximum), Grand Junction, Rifle, Durango, Naturita, and Uravan, Colorado, Salt Lake City, Marysville, Thompsons, and Monticello, Utah, Shiprock, New Mexico, Edgemont, S. Dakota. Base price for 0.10% ore is \$1.50 per pound and up to \$3.50 per pound of contained U <sub>3</sub> O <sub>8</sub> plus \$0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of \$0.25 per pound for each in excess of 10 pounds. A \$0.50 per pound development allowance paid on all ores purchases. At Shiprock all ores with more than 6% lime are penalized for excess lime.	
VANADIUM ORE:	Carnotite-Roscoelite, V <sub>2</sub> O <sub>5</sub> in ratio of more than 10 parts to 1 part of U <sub>3</sub> O <sub>8</sub> are generally acceptable at all AEC depots, but excess not paid for at Marysville, Monticello and Shiprock. ....	Per Pound V <sub>2</sub> O <sub>5</sub> , \$0.31

## NON-METALLIC MINERALS

BENTONITE:	Minus-200-mesh, F.o.b. Wyoming points, Per ton in carload lots .....	\$12.50
	Oil Well grade, Packed in 100 pound paper bags .....	\$14.00
FLUORSPAR:	Metallurgical grade, 70% effective CaF <sub>2</sub> content per short ton F.o.b. Illinois-Kentucky mines .....	\$42.50
	Mexican, 70% f.o.b. border .....	\$30.00
	Acid Grade, 97% CaF <sub>2</sub> f.o.b. Kentucky, Illinois, Colorado .....	\$60.00
PERLITE:	Crude, F.o.b. mine per short ton .....	\$3.00 to \$5.00
	Plaster grades, Crushed and sized, F.o.b. plant .....	\$7.00 to \$9.00
SULPHUR:	Long ton, F.o.b. Hoskins Mound, Texas .....	\$25.50
	Export .....	\$30.50

## LONDON METAL AND MINERAL PRICES

September 22, 1953

		Per Long Ton USA Equivalent cents	
			per pound <sup>1</sup>
COPPER:	Electrolytic, spot	£232 10s 0d	29.06¢
LEAD:	Refined, 99.97%	£90 0s 0d	11.25¢
ZINC:	Virgin, 98%	£69 5s 0d	8.66¢
ALUMINUM:	Ingots, 99.5%	£150 0s 0d	18.75¢
ANTIMONY:	Regular, 99.6%	£237 10s 0d	29.69¢
TIN:	Standard, 99.75%	£609 0s 0d	76.12¢
TUNGSTEN:	Long ton unit, 297s 6d, equivalent to		\$41.66 per unit

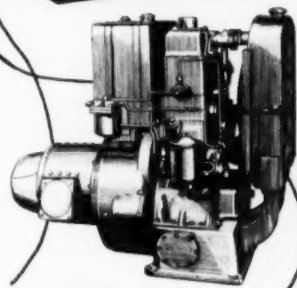
<sup>1</sup> With Sterling pound at \$2.80.

Quotations on metals and certain ores through the courtesy of American Metal Market, New York, N.Y.

OCTOBER, 1953

[World Mining Section—81]

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**NORDBERG  
DIESELS**



COST LESS  
TO OPERATE

In addition to the low initial cost of the 1, 2 and 3-cylinder Nordberg "4FS" series

Diesel engines, the outstanding design and construction of these compact units assures extremely low fuel and lube oil consumption . . . which has been proved in a wide range of power jobs.

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Here are the "extras" that are all included in the low initial cost of Nord-

berg Diesel units: thermostatically controlled cooling system— heavy duty oil bath air cleaner— lube oil cooler— fuel and lube oil filters. Compare before you buy any 10 to 45 hp engine.

LONGER  
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Like all Nordberg Diesels, the "4FS" series engines are sturdily built to give years of reliable service with a minimum of maintenance time and expense.

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BUILDERS OF AMERICA'S LARGEST  
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Send catalog covering Nordberg Type 4FS Diesels. I am interested in a unit for the following service: MW

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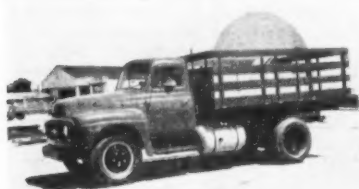
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**FOR PRICE SCHEDULES**

# PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill, or smelter. This PEP section is MINING WORLD'S way of making available to you some of the finest current information on mechanization.

## International Now Makes Liquefied Gas Trucks

International Harvester Co. has placed in production five medium-duty models in the R-160 series with Liquefied Petro-



leum gas fuel systems. These range in gross vehicle weight from 14,000 to 17,000 pounds. Powered by 108 hp. Silver Diamond 240. Compression ratio of 8.4 plus added hp. are available through installation of 10,000 foot pistons. Liquefied Petroleum Gas is typically lower in cost than gasoline. Single or dual 34, 43, and 62 gallon tanks are available. Obtain complete information by circling No. 61.

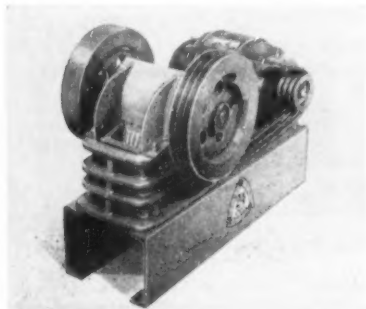
## Wemco Plans to Occupy New Building In Denver, Colo.

Western Machinery Company has signed a long term lease for a new building which will be located at 2400 West 7th Avenue in Denver, Colorado. The owner has contracted for erection of the building and it is expected to be ready for occupancy in November of this year.

New and larger facilities are necessary due to an expansion in sales volume over the past two years. WEMCO services the construction, material handling, and mining industries in Colorado.

## Laboratory Jaw Added To Denver Crusher Line

A new 3¼- by 4¼-inch forced feed laboratory jaw crusher has been announced by the Denver Equipment Company. Op-



erating between 350 and 425 rpm and powered by a 2-hp. motor, it has a capacity of 500 pounds of minus ¼-inch material per hour.

The frame is special alloy iron; jaw plates are manganese steel; and the bumper is fitted with heavy-duty, anti-friction bearings and bronze side bearings. The new unit is an important addition to the Denver forced feed crusher line that ranges in size from the small laboratory 2¼- by 3¼-inch jaw to the big, all anti-friction bearing 32- by 40-inch crusher. Circle no. 56.

## Versatile Front-End Loader For TD-6 Available

Available from the Drott Manufacturing Corporation is the new 6K3 Skid-Shovel, designed and built exclusively for mounting on the TD-6 International tractor. The Drott front-end loader has all the bonus features of larger models, including clean design, job versatility, break-out action, Hydro Spring for reduc-



ing shocks, shoe transportation, and reverse cylinder action.

The new unit has a ¾-yard capacity with a digging- or breaking-out force of 8,500 pounds, a lifting capacity of 3,000 pounds, and has met with field proven popularity wherever bulk handling of material is vital. Complete specifications are available by circling no. 64.

## Oliver United Filter Acquires Centriclone

Oliver United Filters Inc., announces the acquisition for manufacture, sales and service of all rights in connection with the centriclone, from the former owners, Equipment Engineers, Inc. Centriclone applications are closely related to the filtration field, in which Oliver United Filters have been specialists for nearly half a century. The Centriclone is a unique

combination of the conventional liquid cyclone and the centrifuge for separating solid particles of different sizes and specific gravities when suspended in a liquid slurry. Receive more information by circling No. 62.

## Muck It Out With An Open Bowl Scraper

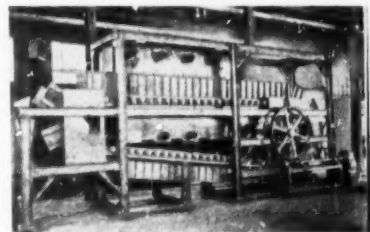
Wooldridge Manufacturing Company has introduced a new tractor-drawn scraper with capacities of 19.0 cubic yards heaped and 15.2 cubic yards struck.



Extremely low center of gravity for good balance and 25 inches ground clearance offer increased maneuverability. Other features include faster and easier loading, positive "roll-out" ejector, large low pressure tires, special wide pusher plate, tire cleaning guards, easy accessibility for service and several others. For more information circle No. 63.

## Taconite Research Leads To Sintering Machines

Sintering Machinery Corporation, designers and builders, offer a new line of Dwight-Lloyd pilot sintering machines for research and production line conditions. The unit illustrated is 24 inches wide by 9 feet. Others range in size from 12 inches by 4 feet to 36 inches by 30 feet. These machines have unusual flexibility for sintering, roasting, agglomerating, calcining and heat treating ores, concentrates, and other materials, and



are designed for intermittent or continuous operation.

Emphasis has been placed on sintering fines by any known or proposed methods, drying or calcining materials and heat treating pellets by baking, incipient sintering or full sintering of individual or agglomerated pellets. Obtain further information by circling number 65.

## Valve Actuators Feature Direct or Remote Control

Designed as package units for installation directly on the valve without outside support, the new Ledeen valve actuators are for the automatic operation of gate, plug, diaphragm, butterfly, pulp stock and other flow control valves.

Operated by air, gas, oil, water, or steam, they feature power operation and



direct or remote control. The line is illustrated and technically described in bulletin 3000 which includes actuator selection instructions and tables. For your copy, circle no. 74.

## Manual On Blasting In Four Languages

A new international rock blasting manual, probably the most comprehensive treatment the subject has ever received, is available through the publisher, Aktiebolaget Atlas Diesel of Stockholm, Sweden, or through the company's branch offices including Copco Pacific Ltd., 930

Brittan Avenue, San Carlos, California; Copco Eastern, Ltd., 151 Linwood Avenue, Patterson, New Jersey; and Canadian Copco, Ltd., A. M. F. Montreal, Quebec, Canada.

The volume is edited in four languages, English, French, German, and Swedish, for easy reference by mining and blasting engineers in all parts of the world. It is leather bound in loose leaf style so that supplementary data can be added in proper sequence when it appears. The publishers rightly expect it to become the worldwide forum for new developments in the field of blasting. The price of the volume is \$15 in United States currency or the local equivalent where the volume is ordered. Further information on the volume and its availability can be obtained by circling no. 39.

## Coquipco Named Western Rep. for TMCO Lubricators

A. L. Watson Company of Milton, Massachusetts has announced the appointment of Coquipco, of Los Angeles, as Western distributor for TMCO automatic grease lubricators. TMCO lubricators are self-feeding pressure grease cups that hold one-half ounce of grease and show at a glance, the amount of grease in the cup. In place, each TMCO lubricator acts as an individual greasum that cannot over-grease its bearing.

According to H. P. Collins, owner of Coquipco, stocks of the lubricators are at present maintained in Los Angeles and San Francisco, and other stocks will be installed in additional Western Cities.

## Notes From The Manufacturers



R. H. RODOLF, has been named general sales manager of Le Roi Company's Construction and Mining Division. Mr. Rodolf was formerly manager of rock drill sales for Le Roi's Cleveland Rock Drill Division. The company has its headquarters in Milwaukee, Wisconsin.

J. T. Ryan, Jr. has been elected president of Mine Safety Appliances Company, succeeding George H. Deike, Sr. Mr. Deike, now chairman of the board, and Mr. Ryan founded the firm in 1914. George H. Deike, Jr. has been elected to a vice presidency. He is also director and treasurer of Mine Safety Appliances Company of Canada, Limited.

George L. Wilcox is new vice president in charge of sales and a director of Westinghouse Electric International Company. He formerly was general sales manager.

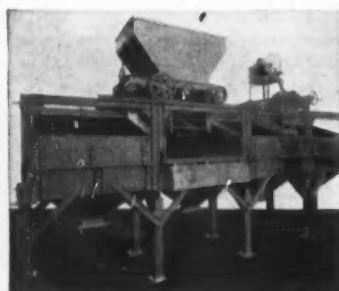
A fourth Thor international company has been opened in Mexico D. F., Mexico at Basilio Badillo No. 47. C. L. Rowett, Thor representative in Mexico, will be in charge of the new office.

## Smelting on Site

with  
**MACE Furnaces**  
and  
**Sintering Hearths**

Saves high transportation and treatment charges on your ores and concentrates.

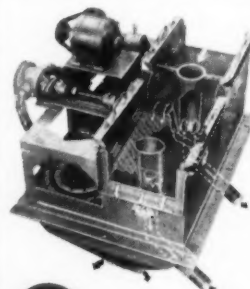
Wire or write for new catalog.



Standard sizes 5 to 250 tons capacity. Working scale tests on ten lots or larger made at our Denver smelter. Send us an analysis for preliminary report.

## The Mace Company

**FIRE CONCENTRATION METALLURGISTS**  
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## DENVER SELECTIVE MINERAL JIGS

• Increase profits by increasing overall mill recovery with a Denver Selective Mineral Jig.

Sizes: 4"x 6" through 36"x 48"  
Most sizes carried in stock.

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NEW ADDRESS.....  
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**KINSEY REPORT:** We have uncovered important pre-publication data from a research volume by a Mr. Kinsey. Unfortunately, a careful search of our Mine Management And Personal files has failed to uncover information on Mr. Kinsey. However, though he is perhaps not a mining man, we have assumed the data he presents to be accurate. Therefore it is with pride we report that, "... 67 percent of all miner's wives read MINING WORLD." And further that, "... 96 percent of these readers prefer MINING WORLD to any other mining publication." [Ed. Note: We hasten to add that these figures are in no way a reflection on mining men. In fact, our notes show that the mining fraternity was interestingly covered in an earlier volume, which see.] Though the volume's subject matter escapes us for the moment and though we suspect that little else in it will prove to be of equal interest, further information is available by circling No. 50.

**MORSE TAPER-LOCK STOCK ROLLER CHAIN SPROCKETS:** Morse Chain Co. offers a pocket-size catalogue (B55-53) giving prices and specifications of their sprockets and chains. It also includes tables on horsepower ratings, Taper-Lock Bushing and sprockets, roller chain (1/2 to 1 1/4 inches) and pitch chain. 5, 10, 50 and 100 foot lengths of individually boxed Morse Packaged Roller chains. Receive a copy by circling No. 1.

**PROFIT MAKER:** The Cat DW wheel-type tractor is loaded with profit-making features according to a new 8 page booklet with on-the-job photographs which emphasize that the Cat DW20 is built for work and long life. Designed for dependable, high-speed earth-moving. To get your copy of Form 30728 circle No. 2.

**WHAT'S IN YOUR ORE?** Denver Equipment Company can help you by testing your ores, designing your flowsheet, designing your mill, selecting proper equipment and providing field service. Bulletin G-5307 describes Deco services and illustrates new Denver equipment in stock for quick delivery. For your copy circle No. 3.

**YOUR SHOVEL HAVE A THIRD DRUM?** Just released by the Thew Shovel Company is a new 12 page color bulletin illustrating and describing the Lorain

"80" Series of power shovels (1 3/4 yd class) and cranes. Illustrated features are roller bearing-mounted swing shaft and hoist drum, hydraulic coupling which prevents shocks and stalling in shovels, and the combination third drum and precision boom lowering device for cranes. For this bulletin circle No. 4.

**FIT YOUR CRUSHER TO THE JOB:** A new booklet giving information on how to go about making the most efficient and satisfactory application of various types of crushers to specific jobs has been published by the Pennsylvania Crusher Company, 1738 Liberty Trust Bldg., Philadelphia 7, Pa.

Power consumption, parts wear, maintenance costs, uniformity of product and others are discussed in detail. Five types of hammermills, jaws, impactors, granulators, gyracones, Bradmills, Bradford Breakers, Bradford Hammermills and several types of single rolls are covered. A valuable addition to any engineers or operating man's library. It will be sent free of charge to anyone sending in a request on a company letterhead.

**TANDEM SLUSHER WITH ALL ADVANTAGES:** Vulcan Iron Works offers a new slusher with extra heavy construction, large capacity, narrow width, easy positive control, and many more features to do a better job for you. Circle No. 5.

**HOISTS THAT GIVE A LIFT TO MINE EFFICIENCY:** Put your hoisting problems in experienced hands with Stearns-Roger Manufacturing Company. For complete data on a large line of hoists, circle No. 6.

**PROSPECTOR DIAMOND CORE DRILL:** Weighs only 600 pounds, for holes up to 300 feet deep and the choice of drill operators for dependability and economy. E. J. Longyear Co. also offers contract drilling, shaft sinking and geological investigations. For further information circle No. 7.

**LATEST FLOTATION INDEX:** 23rd Annual Edition of Dow Chemical Company's authoritative guide to published material on flotation is now being printed. Copies may be obtained by writing to Dow Chemical Co., 310 Sansome St., San Francisco, Calif., or by circling 46.

**FOR FAST, UNIFORM ORE SAMPLE PREPARATION:** Denver Fire Clay's crushers and pulverizers are simple, rugged and trouble-free. Everything for the assay laboratory. For information circle No. 8.

**NEED A WINCH?** Stephens-Adamson Manufacturing Company announces a new bulletin on "Hand and Motor Winches." Receive Bulletin #853 by circling No. 9.

**BEEN PUSHING RAIL CARS?** A new bulletin on Car Pullers (No. 753) is available from Stephens-Adamson Manufacturing Company. For a copy circle No. 10.

**STOP FUEL FAILURES:** Worthington's new "Automatic fuel switcher" eliminates fuel failures. When gas pressure drops below normal or fails completely, the engine automatically changes over to 100% fuel oil instantly. For more details, circle No. 30.

**SCREENS FOR HIGH RECOVERY CONTENT:** Hendrick "Wedge-Slot" Screens have very small openings yet have greater draining and screening capacity. They retain material that would ordinarily be wasted or cause expensive time delays for reprocessing. Investigate by circling No. 11.

**GYRATORY LINERS REBUILT ECONOMICALLY:** N. M. Mangatone and Resisto-Loy both products of Resisto-Loy Company offer liner rebuilding that will save you materials and money. For complete info on how you can benefit by rebuilding worn surfaces, circle No. 12.

**A REALLY TENACIOUS GEAR LUBRICANT:** Houghton's new TENAC will give you a new idea of lubrication economy. Highly adhesive heavy-duty lubrication for open gears and cables. More details are yours by circling No. 13.

**WET CLASSIFICATION PROBLEMS SOLVED:** WEMCO's S-H (Special-Helix) Classifiers are completely covered by their Brand New Catalogue No. C-1-S-2. Its 20 pages are packed with data on wet classification. This Bulletin is a MUST for anyone concerned with wet classification, open circuit or closed circuit grinding, desliming, washing and dewatering. Circle No. 21.

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to get further information on any item described in the Production Equipment Preview, note the key number of that item, circle the corresponding number on the REP card at the right, and mail. If mailed from a point outside the United States, proper postage must be used.

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**LIKE TO SET A PRODUCTION RECORD?** Then look at what a Traylor crusher can do for you. Traylor TC Gyrtory Crushers have set production records all over the world and could for you too. For their Bulletin 126 . . . to increase your production at a profit . . . circle No. 14.

**NEW "BLAST HOLE" DRILL:** For percussion deep hole drilling; Gardner-Denver's Model SFH99 permits a 4 foot change in a 7 foot drift—saves time and development work. A natural partner for Low Cost Blast Hole Drilling. For complete details circle No. 15.

**ROCKER CARS BUILT TO LAST FOREVER:** That's the way Sanford-Day Iron Works builds the S-D Rocker Car. Extra welding, extra rivets and extra reinforcing where it should be; cars built up to a service requirement, not down to a price. For more information circle No. 16.

**TUNGSTEN CARBIDE AND SINGLE USE BITS BOTH FIT THE SAME DRILL STEEL:** The TEE CEE (Tungsten Carbide Insert) Bit is designed for on-the-job interchange with the famed Liddicoat bit that is "used to destruction." Made by Western Rock Bit Manufacturing Company, receive more information by circling No. 17.

**MINEPHONE AND HOISTPHONE COMMUNICATION SYSTEMS:** These two will help you talk your way to greater tonnage . . . Safely. Mine Safety Appliances offers additional information by circling No. 18.

**CABLE SPLICING:** Canton cable splicers, Canton vulcanizing splicers and cable vulcanizers are designed for safe cable maintenance. The American Mine Door Company offers complete literature. Yours by circling No. 19.

**EFFICIENT DIESEL POWER AT LOWER COST:** When it comes to power for any heavy duty service . . . or compressors to meet your air needs . . . you'll be money ahead with modern, trouble-free Cooper-Bessemer on the job. Descriptive bulletins are yours by circling No. 20.

**ARE YOU ISOLATED?** Power for Isolated Communities is the title of a new 8 page booklet by Caterpillar Tractor Company. Various Cat built Diesel Elec-

tric Sets (16 to 315 kilowatts) are shown operating in Africa, Alaska, and South America. The story of just how Diesel Electric sets may serve as inexpensive power and a chart listing all available Caterpillar units and their kilowatt output are included. Receive a copy of Form 30619 by circling No. 22.

**DOES FLUORSPAR FLOAT?** A case history of Fluorspar flotation describes how Denver "Sub-A" Flotation provides greatest flexibility in cleaning and re-cleaning without the use of pumps or expensive mill floor step-downs. Get a series of flowsheets in Bulletin FLO-B80 (illustrating flexibility allowing operators to change operating conditions as the particular ore characteristics change) by circling No. 23.

**NEED INFO ON CHROME STEEL BALLS?** Applications for Fischer chrome steel balls, stainless steel balls and sundry balls are covered in a new booklet released by Frazer & Company distributors for Kugelfischer Georg Schaefer & Company of Germany. Under each listing are the applications for bearings in armatures, valves and pumps, as casters, burnishing balls, gauge balls and crushing and grinding balls. For your copy circle No. 24.

**DO YOU KNOW HOW TO HANDLE PIPE LINE LEAKS?** Find out how they can be repaired in but "a matter of seconds." Circle No. 25.

**"HOW TO OPERATE A LIFT TRUCK";** Two-color cartoon technique intended for both the beginner and the experienced operator and can be used individually or as a guide by instructors. Also includes drawings for setting up an obstacle course. Get yours by circling No. 26.

**IS YOUR ELECTRICAL SYSTEM AN ASSET OR A LIABILITY?** A complete "How to do it" sales promotion package aimed at securing better-than-adequate wiring on the farm, in the home, in small commercial enterprises and continuous operation for big industry and big business on electrical system planning, maintenance and modernization. All your problems on wiring solved by circling No. 27.

**TORQUE DRIVES:** The advantage of the Allison Torqmatic Converter where additional torque ratios, greater pay loads, quick shifts under full throttle, finger-tip control, increased service availability, and

reduced operator fatigue are desired, are all described in two bulletins describing Allison Torqmatic transmissions. To get your copies of bulletins covering models TG-602 and TG-607, circle no. 29.

**SMALL BALL ROD MILL:** The 30-inch diameter Denver convertible ball rod mill has been vastly improved for greater efficiency and to facilitate repairs. This machine is now available in 30- by 18-inch, 30- by 36-inch, 30- by 54-inch, and 30- by 72-inch sizes. Any model can be increased to 72 inches by increments of 18-inch sections. Circle no. 36.

**GAS-GASOLINE POWER:** With the addition of seven new six-cylinder models, the International Harvester gas-gasoline power unit line now includes 12 engines ranging from 16.5 to 200 net maximum horsepower. Engine features include: full-pressure lubrication, Equi-Vapor manifold system; cam-ground aluminum pistons with oil-saving U-flex type rings; and a seven-bearing counter-weighted crankshaft. For further details, circle no. 37.

**DRAGLINE BUCKET:** The Electric Steel Foundry Company has developed a heavy-duty standard dragline bucket of all welded tapered side construction that has Timken bearing water sealed dump block, flat-link manganese hoist chain, tubular spreader bar, swivel dump socket, cast alloy steel tubular arch, cast alloy or manganese steel lip, specially designed manganese drag chain, renewable corner wear shoes, and many other outstanding features. Circle no. 38.

**LUBRICANTS:** World wide markets are being developed for the use of the lubricants developed by Jet-Lube, Inc. These greases contain molybdenum, aluminum, copper, and lead in various combinations for special adaptations in the mining industry. For further details, circle no. 40.

**KILN AND DRYER CONTROLS:** A new catalog of control instruments for furnaces, ovens, dryers, and kilns is available through the Bristol Company. It features Electronic Dynamometer potentiometer and millivoltmeter type pyrometer controllers, recorders, and indicators. A wide variety of electric, air-operated, and electronic control instruments for use with fuel-fired and electric heating equipment of all types is listed. For a copy of catalog no. P1255, circle no. 28.

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## Four More 50-ton Euclids Delivered to Mining

Four 50-ton Euclid rear dump trucks, recently delivered to the Utah Construction Company for use at Geneva Steel Corporation's operations near Cedar City, Utah, bring the number of these big Eucs now in service to 42.

The first of these big twin-powered trucks, with rear axles driven through individual torque converters, semi-automatic



transmissions, and 300-hp. Diesel engines, was put in service just two years ago. They have proven to be reliable units that stand up in heavy service and handle as easily as smaller Eucs. Circle no. 66.

## New Principle Developed in Wire Rope Construction

A new principle in wire rope construction, which many believe will solve a 50-year-old problem in deep-well drilling, has been developed by Jones & Laughlin Steel Corporation. The new principle employs the ability of the coiled spring to flex and to resist crushing. The result: a wire rope with a core that is a coiled steel spring. No wire rope previously manufactured has employed this principle.

According to J&L's Douglas J. Heneker, "Field tests made with the spring-



center wire rope show clearly that it will have the long life, despite hard usage, which rotary rig drillers have been seeking for many years." For details, circle no. 71.

## International Harvester Forms New Sales Group

Because of the growth and expansion of International Harvester's industrial power line of products in recent months and because of the growth of sales in other lines handled by the General Sales Department, the company has established a separate Industrial Power Sales Department. The new sales unit will be manned by Harvester people who, by training and long experience, are espe-

cially qualified to handle the many specialized problems that are a part of the earth-moving and industrial power fields.

At the same time the company announced the appointment of I. P. Payne as manager of the new department. Payne has been associated with the sale of IHI industrial power products since 1937 when he became an industrial salesman at Harvester's New Orleans, Louisiana, district sales office. Assisting Payne will be W. M. Holland and C. E. Jones, who have been appointed assistant managers of sales, Industrial Power Division. The field sales organization will include three regional sales managers, three assistant regional sales managers, and twenty territory managers. A staff of sales engineering, service, and parts specialists will aid these field sales people in their work. Headquarters of the new unit will be with the other industrial power divisional offices at Harvester's Melrose Park Works, Melrose Park, Illinois.

## Duplex Crushing Plant For Use in Gravel Pits

Pioneer Engineering Works, Inc., a subsidiary of Poor and Company, has added a new duplex crushing and screening plant to its popular line of portable plants.

The new model, 35-S is a lightweight, in-line plant, primarily designed for use in gravel pits. The in-line feature means that the basic flow of material is in line,



longitudinally, with the axis of the plant, the material being fed into the rear and discharged at the front end.

The 35-S consists of a jaw crusher, a double roll crusher, 2½-deck vibrator screen, and the necessary conveyors. Circle no. 59.

## Patented Windbox Seal Increases Sinter Output

Sintering Machinery Corporation is equipping its metallurgical models of the Dwight-Lloyd sintering machines with the new Rowen Windbox Seal. This new seal permits more efficient combustion, faster machine operation and greater production. Because air volume requirements are lower, operating economies are assured.

The new seal is located outside the windbox, unaffected by the abrasive and corrosive effects of the sinter fines and hot gases—substantially increasing the life of the seal. This new positive pressure seal holds bearing surfaces in continuous contact with the replaceable wearing bars. All parts are readily accessible for inspection and adjustment. Circle No. 76.

## Milling Machine Slots Drill Rods for Inserts

The Mayo Tunnel and Mine Equipment drill rod slotter is a milling machine designed for cutting slots in your present drill rods. Field brazing of Kennametal inserts has been developed for economical and efficient on-the-job conversion of conventional drill steel to carbide tipped drill rod.

Mayo's slotter can be set up in any mine machine shop and should prove to be a valuable unit at mines where insert drill rods or bits are being used. For full information on the slotter and the method of adapting conventional steels, circle No. 60.

## Acidproof Sump Pump Defies Acids and Sands

The new Galigher 1½-inch acidproof sump pump handles acid sludges, corrosive and foamy products with solids in suspension and all types of difficult pumping where heads up to 35 feet and flows to 75 gallons per minute are required.

The pump is suitable for abrasive pulp and acid transfer in mills, smelters, and similar operations. This simple welded vertical unit is completely rubber lined and covered. The overhang suspended shaft design eliminates all submerged bearings, packings and other parts which normally cause trouble.

The pump operates until the sump level is below the lower suction cover and will empty tanks to within 2½ inches of the bottom. Neoprene and special rubber compounds are available for unusual applications. A new bulletin, SP-53, completely illustrates and describes the pump. Circle no. 72.

## Heavy-Duty Truckline Designed to Resist Shock

New International Loadstar models, built to operate where maximum loads must be carried and the truck is sub-



jected to a high degree of twisting or shock, highlight International Harvester's new R-line of motor trucks. The Model R-184 Loadstar shown here is a 142-inch wheelbase truck with a 4-yard dump body and has a gross vehicle weight rating of 21,500 pounds. This model is available in four wheelbases from 130 to 172 inches. Powered by the new 130-hp International Black Diamond 282 engine, gasoline or LPG fuel systems are available. For information on the Loadstar line, circle No. 80.





## UNOBA grease helps move mountains

This giant electric shovel digs out rich copper ore with a four-cubic-yard bite. Dependable lubrication is vital to trouble-free operation of rugged equipment like this. That's why this shovel has the protective lubrication of UNOBA grease.

UNOBA gives outstanding pro-

tection against rust and corrosion. Even steam cleaning and boiling water don't cut UNOBA's film.

UNOBA eliminates excessive wear because its tenacious coating cushions straining and grinding gears, helps absorb shocks.

UNOBA is a multi-purpose

grease. By using UNOBA you reduce grease inventories... lessen the chance of using the wrong lubricant... save yourself time and money.

Give your equipment the dependable protection of multi-purpose UNOBA grease.

Developed by the makers of DRILLUBE air drill lubricant.

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## precipitates—CENTRAL and EASTERN

### Coronet Phosphate Bought By Smith-Douglass Co.

Smith-Douglass Company of Norfolk, Virginia has purchased all the stock and physical assets of Coronet Phosphate Company, producers of pebble phosphate rock and raw materials from which fertilizer and defluorinated phosphate are made.

The Coronet firm formerly produced about 10 percent of the rock phosphate in the United States. It owned a defluorination plant, mines, and deposits in Hillsborough County and at Tenoroc in Polk County, Virginia. Land tracts involved over 12,515 acres representing 4,116 acres of minable deposits. The Tenoroc facilities include drying and storage facilities capable of handling 500,000 tons of rock annually.

B. G. Dabney, general superintendent of the Coronet company operations, will retain the same position under the new management. George H. Burt is secretary-treasurer of the newly formed Coronet division of the Smith-Douglass Company.

### United Steelworkers, U. S. Smelting Reach Agreement

On August 11 the U. S. Smelting, Refining & Mining Company and the United Steelworkers agreed to extend the contract which expired on June 30th, 1953 to June 30th, 1955. The agreement will be reopened on June 30, 1954 for matters of wages, shift premium pay, holidays, and group insurance.

It provides for alternate five- and six-day work weeks for the period of the contract. It also specifies that the company may reopen the contract on wage rates if the combined price of lead and zinc should drop to 23 cents per pound, and that the union may do the same if the combined price reaches 30 cents a pound. The contract prohibits, however, two reopeners within 60 days preceding June 30, 1954. The company agreed to increase its group insurance contribution from \$5.20 to \$6.50 per eligible employee per month. There were no changes in wage rates, differentials, or classifications.



The General Services Administration has signed a contract with the *Copper Range Company* of Boston, Massachusetts for the delivery of 7,965,000 pounds of refined copper from the company's *Champion* mine at Painesdale, Houghton County, Michigan. The government will pay 32 cents per pound Connecticut Valley, less a differential of one cent per pound for all deliveries

OCTOBER, 1953

made via common carrier to the refinery. Scheduled output is as follows: 1,593,000 pounds in 1953; 3,186,000 pounds annually in 1954 and 1955. The agreement ends December 31, 1955 or earlier if full production has been reached. The government had a previous agreement with the firm signed on March 18, 1952. That agreement terminated when copper was removed from price controls in February of this year. The firm has been operating without government assistance since then but reports it cannot continue to do so.

The *Aero Service Corporation* of Philadelphia has established the *Aero Service Corp. (Mid-Continent)* at Tulsa, Oklahoma. The new firm, formerly *Frost Airborne Surveys Corp.*, will offer a greatly expanded aerial exploration and mapping service in the central United States. In addition to airborne magnetometer surveys for oil and minerals, the new firm will perform photo-geologic studies, photo-mapping, topographic mapping, and other geophysical and photogrammetric services.

Miners of the *Rosiclare Lead and Fluorspar Mining Company* in Hardin County, Illinois, have accepted a new wage contract which calls for, among other things, a bonus for production. The company will pay \$2.00 per ton bonus for every ton produced over the monthly

average production from soft ground, and \$1.00 per ton bonus for each ton produced over the monthly average production from hard ground. The bonus will be divided among the men in proportion to man hours worked.



Primary aluminum production in the United States during the first half of 1953 totaled 598,704 tons, an increase of 30 percent over the 461,536 tons produced during the same period of 1952. More primary aluminum was produced in this first half of 1953 than during the entire years of 1945, 1946, or 1947.

Operations at the *Hamme tungsten* mine of the *Tungsten Mining Corporation* near Henderson, North Carolina, are reported as very satisfactory with production during the past few months remaining above estimates. Since the effects of the strike were overcome in February, average monthly-production has been 11,500 units of 65 percent  $WO_3$  concentrate. Changes in the slime section flow sheet made when the mill was doubled



### DEVELOPMENT WORK ON GOGEBIC RANGE

After eight months of operation, the Loomis open pit mine is approximately 100 feet deep, 500 feet wide, and 1,100 feet long as shown in this picture above. Pickands Mather & Co. operates this mine on the Gogebic Range for the Plymouth Mining Company of Wakefield, Michigan. About 8,000 tons of overburden and iron ore are removed from the pit each 24 hours; 2,300 tons of this is regular Gogebic grade (soft) ore. The operators are experiencing difficulty with caving pit walls, but this has been overcome now by methods of wall stabilization. Three  $2\frac{1}{2}$ -cubic-yard power shovels load ten 15-ton Mack rear-dump and three 21-ton Euclid rear-dump trucks in the pit for the half mile haul to the dump. Two of the shovels are Northwest 80-D, and the other is a Bucyrus-Erie 54-B. Shovels, trucks, and a bulldozer are all Diesel-powered. Ed Tyler is assistant superintendent, and O. Vispi is engineer at this mine.

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in size are said to have improved recovery.

Government buying of strategic mica has been extended until June 30, 1957 under the extension of the domestic strategic mineral buying program recently approved. The General Services Administration will now buy all three grades of non-ruby mica, but at least 20 percent of good stained or better must be included in any lot offered to the purchase depots.

#### NON-RUBY MICA PRICES PER POUND

Grades	Qualities (full-trimmed)		
	Good stained and better	Stained	Heavy Stained
No. 3 and larger	\$56.00	\$14.40	\$10.40
No. 4 and 5	32.00	6.40	4.80
No. 5½ and 6	12.00	4.00	2.40

Qualities (half-trimmed)			
No. 3 and larger	—	9.60	6.40
No. 4 and 5	—	4.00	3.20
No. 5½ and 6	—	2.40	1.60

Both full-trimmed and half-trimmed for stained and heavy stained non-ruby mica will be accepted. Good stained must be full-trimmed. The area of the minimum rectangle for full-trimmed will be: No. 6, 1 inch; No. 5½, 2½ inches; No. 5, 3 inches; No. 4, 6 inches; No. 3 and larger, 10 inches. Minimum dimension of half-trimmed will be: No. 6, ¾ inch; No. 5½, 7-8 inches; No. 5, 1 inch; No. 4, 1½ inches; No. 3 and larger, 2 inches.

Work has started on the construction of the \$1,400,000 chemical research laboratory *Battelle Institute* is building at Columbus, Ohio. The structure is scheduled for completion in the fall of 1954.

*Brown & Root, Inc.* has created a Mining and Metallurgical Division with offices at No. 1 Wall Street, New York City. Domingo Moreno and Eugene H. Monroe, mining engineers, will be on hand to offer engineering, process designing, consulting, and construction services to the mining industry.

Development is planned for a manganese deposit in the Sherman Valley in eastern Bedford County, Pennsylvania. A vein 400 feet wide and 2½ miles long is being investigated by a group of West Virginia businessmen who reportedly have already started construction of an ore crusher and washer on the property. The manganese minerals are to be separated from the red shale in which they are found by means of jets of pressurized water. A new firm, *Manganese Mining Company* has been organized to conduct the operations.

The *United States Atomic Energy Commission* has stated in its semi-annual report that substantial progress is being made in discovering new sources of uranium and increasing uranium mining both in the United States and abroad. Uranium production from domestic ore made particularly good gains. A new ore processing mill being erected by *Anaconda Copper Mining Company* at Bluewater, New Mexico is almost finished, and other processing mills are planned by *Kerr-McGee Oil Industries, Inc.* at Window Rock, Arizona, and *Vanadium Corporation of America* at Hite, Utah. By-product uranium recovery plants nearing completion are at Mulberry, Florida by *International Minerals & Chemical Corporation* and Virginia-Carolina Chemical Corporation, and at Texas City, Texas by *Texas City Chemicals, Inc.*

**MINING WORLD**



The West Hill mine operated by Pickands Mather & Co. on the western end of the Mesabi Range between Coleraine and Grand Rapids is now producing iron ore. First ore was processed and concentrate loaded for shipment on July 7. The plant is a combination wash and heavy-media type with wash ore shipped directly if suitable. Should further treatment be required, the ore undergoes the heavy media process. Approximately 4,000,000 tons of overburden have been removed since stripping operations began in December 1951. Construction of the plant crusher and other mine buildings, in addition to haul roads, has been in progress for the past 19 months.

The Great Lakes Dredge & Dock Company has started to dredge the site of Reserve Mining Company's new ore shipping port near Beaver Bay, Minnesota.

The State Executive Council has approved the granting of one-year permits to prospect for iron ore on 35 units of Minnesota state-owned land. Most of the units are unexplored or partially explored. Eighty-six bids were received and permits were granted to the highest bidders. The following persons and firms were awarded two permits each: *Conns Pacific Company*, Hibbing; *F. L. Palatine*, St. Paul; *Pacific Isle Mining Company*, Hibbing; *Pittsburgh Pacific Company*, Hibbing; and *Sadler Ore Company*, Duluth. These companies were awarded one permit each: *Haley-Young Mining Company*, Hibbing; *Sylvia-Dee Mining Company*, Buhl; *Cleveland-Cliffs Iron Company*, Hibbing; *United States Steel Corporation*, Duluth; and *Western Mining Company*, Duluth.

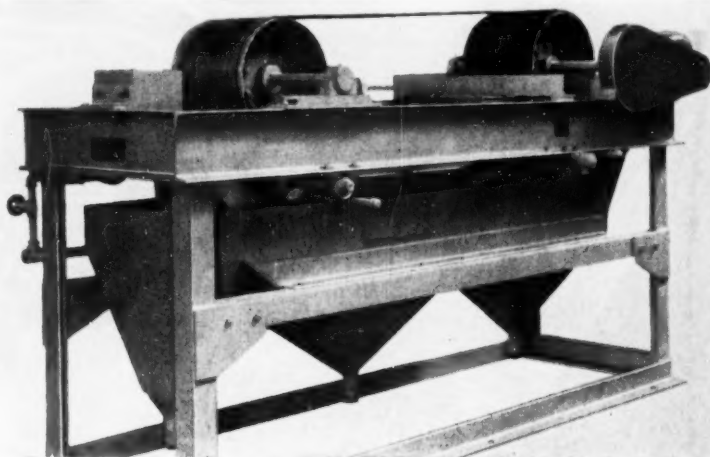
As of August 24th, 61,945,985 gross tons of iron ore have been shipped from upper lake ports. This compares with 34,111,694 tons shipped in a similar period last year when a two-month strike interrupted operations. In the 24-hour period ending at 12:01 A.M., July 29th, the Great Northern Docks at Superior, Wisconsin shipped 262,184 tons of iron ore, a record shipment.

Greater quantities of water are being required in the new methods for beneficiating taconite and jasper on the Minnesota and Michigan iron ranges. The Water Resources Division of the United States Geological Survey, in cooperation with the Division of Waters of the Minnesota Department of Conservation and the Minnesota Iron Range Resources and Rehabilitation Commission, is now compiling and studying all available data pertaining to water resources of the range areas in order to insure ample quantities in the future both for mining and for the increasing populations to be housed in new mining towns. Water is not plentiful on the topographic highlands where the iron ranges are located; surface streams generally are small and ground-water storage limited.

Cleveland-Cliffs Iron Company has enlarged its offices at Ishpeming, Michigan, to provide additional space for the expanding geological and engineering departments.

OCTOBER, 1953

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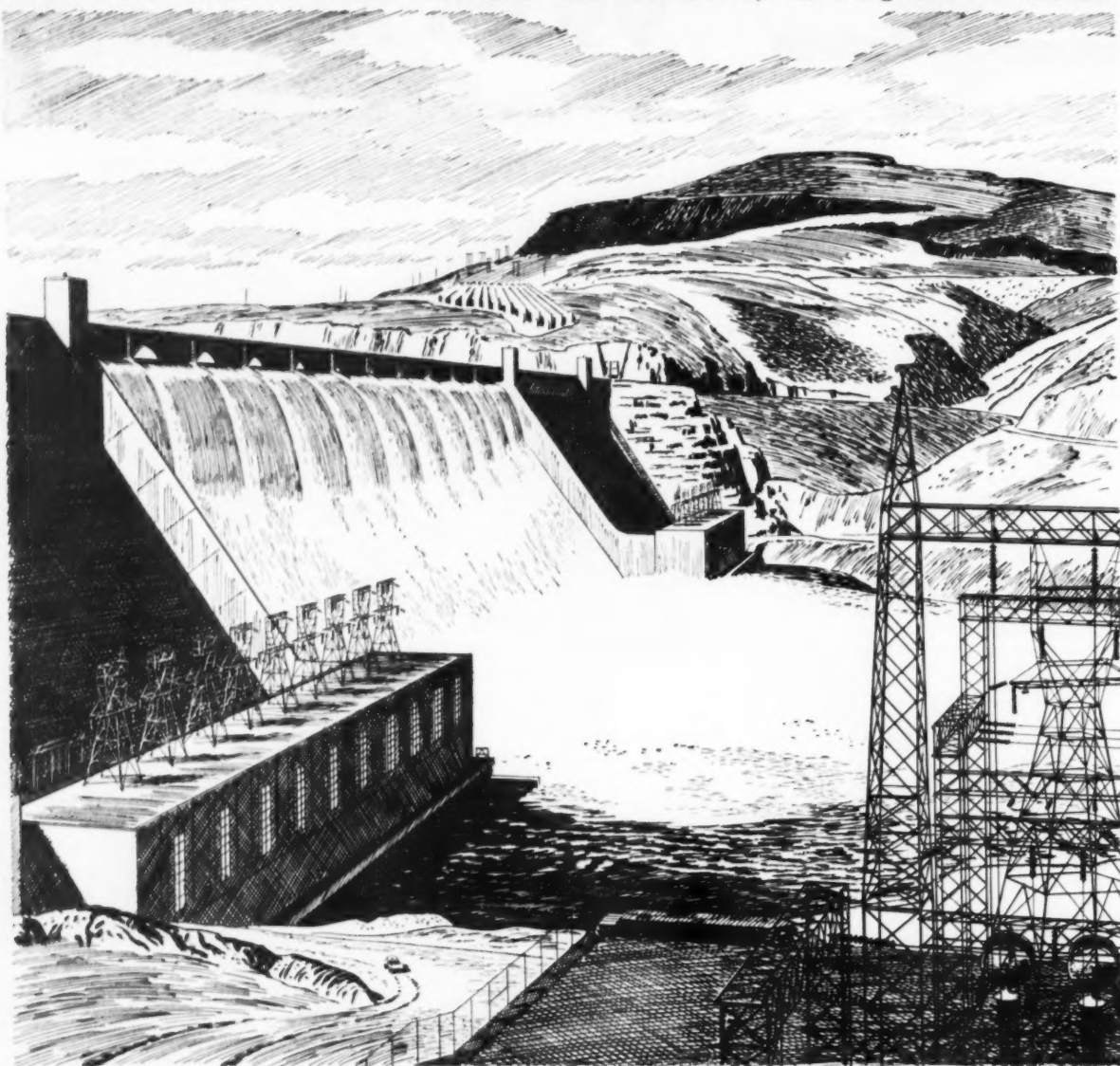
# MAGNETS

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## precipitates—ROCKY MOUNTAIN

### New Jersey Zinc Closes Mine, Mill in Colorado

The eagle mine and the mill of the Empire Zinc Division of the New Jersey Zinc Company at Gilman, Eagle County, Colorado have been closed because of the low price for base metals and union demands for higher wages for employees.

For a number of years the Eagle mine has been the most important zinc producer in Colorado and its dollar value of output was the largest of any base metal mine. In 1952, as usual, it led the state in zinc production, was third in lead, and second in silver production. The mine produced 298,083 short tons of ore, the greater part of which was treated in the 1,000-ton-per-day differential zinc-lead flotation mill, the only underground mill in Colorado. From this ore, 1,700 fine ounces of gold were recovered; 348,090 ounces of silver; 195 short tons of copper; 3,980 tons of lead; and 26,000 tons of zinc.

Zinc-lead deposits occur as replacements and mantos in the Leadville limestone and are mined by square set stoping. Within the replacement deposits are masses of copper-silver-gold ore forming pipes or chimneys. The two types of ore are mined separately; the chimney ore is shipped directly to a smelter, while the zinc-lead ore is milled.

Closing of the mill will necessitate the closing of the company's roasting plant at Canon City, Fremont County, Colorado where all zinc concentrate is roasted before shipment of the calcine to mid-west and eastern smelters of the company. Roasting results in an appreciable saving in freight as moisture and sulphur are eliminated from the concentrate.

Only a maintenance crew will be kept at the mine, according to W. L. Jude, superintendent of the Gilman operations.

### U. S. AEC Releases News On Radioactive Areas

Since August 15th the United States Atomic Energy Commission has been releasing information concerning the location of surface areas of unusual radioactivity that have been found by geological reconnaissance conducted on the ground. However, an AEC release indicates that the locations of radioactivity may not necessarily indicate commercial orebodies of uranium. Index maps showing location of anomalous areas are being posted simultaneously at noon, Mountain Standard Time, at various AEC offices throughout the country on the 15th of each month or the first succeeding working day if the 15th falls on a Saturday, Sunday or a Federal holiday.

Offices in the Rocky Mountain area include: Denver Exploration Branch, AEC, Denver Federal Center, Denver, Colorado; Hot Springs Suboffice, AEC, Hot Springs, South Dakota; Bureau of Mines Office, Rapid City, South Dakota; U. S. Geological Survey Office, Custer, South Dakota; Grand Junction Operations Office, AEC, Grand Junction, Colorado; Salt

Lake Exploration Branch, AEC, Salt Lake City, Utah; Richfield Suboffice, AEC, Richfield, Utah; U. S. Atomic Energy Commission Buying Station, Monticello, Utah; Butte Suboffice, AEC, Butte, Montana; U. S. Geological Survey Office, Worland, Wyoming; U. S. Geological Survey Office, Casper, Wyoming; and Douglas Suboffice, AEC, Douglas, Wyoming.

### Utex Considers Uranium Processing Mill Near Moab

Utex Exploration Company is investigating the possibility of building a uranium processing mill near Moab, Utah at a probable cost of \$3,000,000. Utex is reportedly discussing the project with the Grand Junction operations office of the United States Atomic Energy Commission. Company officials say that there is a sufficient reserve of uranium ore developed on the Utex property and on other discoveries in southeastern Utah to justify construction of a mill.

Ore from the firm's Mi Vida mine, assaying up to 87 percent uranium, is now being stockpiled at Monticello, Utah, until processing methods are developed to handle it. According to Sheldon P. Wimpfen, manager of AEC's Grand Junction office, pilot plant work on a process for the Utex ore is "about ready to start."

Diamond drilling north of the mine has uncovered a new orebody, assaying up to

3 percent  $U_3O_8$ , and carrying favorable vanadium.



The *Shenandoah-Dives Mining Company* is advancing its Letter G crosscut 12 feet per day from its Mayflower workings at Silverton, San Juan County, Colorado. The crosscut to the vein and drifting and raising on the vein are part of a joint company-DMEA exploration program started in July. Cost is estimated to be \$211,900. Records indicate good production from the vein through old workings several hundreds of feet above the horizon where the crosscut will intersect the vein. Charles A. Chase, executive vice president of the company, initiated the work, and Edwin A. Larson, resident manager, supervises the exploration program.

*Golden Cycle Corporation's* new shaft at Uravan, Montrose County, Colorado, which is to be sunk to a total depth of 650 feet, is 50 percent completed after nine weeks of work. Gene Bishopp, well-known mining contractor of Boulder, Colorado, has contracted the shaft sinking program. The property, on Atkinson



### URANIUM-COPPER ORE IN MOENKOPI

A view of the bottom and lower walls of the White Canyon in San Juan County, Utah which are of the Cutler Formation of Permian age. The Moenkapi Formation of Lower Triassic age rests on the Cutler. Note the mine road extending from the right edge of the picture—this is about the middle of the Moenkapi Formation. In White Canyon, a sandstone or conglomerate in the middle or upper two-thirds of the formation is the locus of uranium-copper mineralization. The well-known Happy Jack uranium-copper mine is one of several operations in the White Canyon area. An extensive development program has blocked out large tonnages of high-grade uranium at the Happy Jack and this mine is a primary source of uranium ore for the Hite, Utah pilot plant of Vanadium Corporation of America.

Mesa, is held by Golden Cycle under lease from the United States Atomic Energy Commission. Production is expected by the end of the year.

Frank Eichelberger and Associates have reportedly been making extensive metallurgical tests on perovskite ( $\text{CaTiO}_3$ ) samples from the Iron Hill district of Gunnison County, Colorado. According to Mr. Eichelberger, tests indicate that titanium metal can be produced more cheaply from perovskite than from rutile ( $\text{TiO}_2$ ). Test samples used were from the mining claims controlled by a syndicate composed of John E. Bryne of Washington, D. C., and D. C. Edwards and Mrs. Winifred Shelton of Dallas, Texas. The Gunnison County perovskite deposit is one of the world's largest. The mineral is found as a

magmatic accessory mineral and as a deuteric product in melilite rocks.

It is reported that gold ore worth as much as \$40 to \$50 a pound has been discovered on the 3,100 foot level of the Golden Cycle Corporation's Ajax Mine on Battle Mountain near Victor, Colorado. Two underground vugs have been blasted into and the walls have been found to contain sylvanite  $\text{Ag}_3\text{Au}_2\text{Te}_2$  and calaverite  $\text{Au}_2\text{Te}_2$ . The vugs are about 15 feet apart in a stope in the Bobtail vein. One vug is about 20 feet in length. The other extends upward at least 25 feet and then narrows. The biggest is about four feet in diameter in its widest part. The other is smaller and narrows to about a foot in diameter.

It is reported that a vein of tungsten ore

has been found on the fifth level of the Cold Springs mine in the Nederland district of Colorado. The vein is four to five feet wide and has been opened up for a length of 60 feet. The ore is assaying 35 percent. The mine is under lease to the Cold Springs Tungsten Company. G. C. Ridland is manager.

Great Eastern Mining Company of Silverton, Colorado has released the following production figures for 1952: gold, 1,000 ounces; silver 109,959 ounces; copper, 101,184 pounds; zinc, 595,389 pounds; and lead, 2,458,729 pounds.

The Atlas Mining and Manufacturing Company of Delta, Colorado, has been trucking iron-oxide from its holdings near Ophir, Colorado.

Lightner Creek mine claims near Durango, Colorado may prove to contain uranium ores. A. S. Butell and Frank W. Pinkerton reportedly plan to develop their properties from which they shipped vanadium during World War II.

The Resurrection Mining Company is operating its large zinc-lead flotation mill at Leadville, Lake County, Colorado on a reduced basis and is treating custom ore only, according to Morton McKay, mill superintendent. Meanwhile, the company continues exploration drilling in Iowa Gulch and plans to unwater the old Helena mine shaft at some future date to check geologic information indicated from drill cores. A crew of 25 men is employed, nine in the mill and the remainder watchmen and exploration personnel. Barney B. Greenlee continues as Resurrection general manager from his new headquarters at Hope, British Columbia. He will check Resurrection developments every two or three months.

A proposed \$303,331 road project will open up the uranium mining area of southwestern Colorado. The project includes rebuilding five miles of State Highway No. 145 between Redvale and Naturita, Colorado.

A nine-foot-diameter Axivane exhaust fan which has been installed at the Storke Level of the Climax Molybdenum Company at Climax, Colorado will enable parts of the mine, which heretofore have only been open during the summer months because of severe ice conditions, to remain open during the winter. The fan displaces 200,000 cubic feet of air per minute with ultimate capacity at 300,000 cubic feet per minute. The fan, located near the Storke exhaust raise, pulls old air up into the Phillipson Level; from there it is moved down a drift and eventually out of the mine. In winter, air will be reused. The already warm air will be put through a series of filters to remove the dust particles. It can be used for circulation and also to warm some of the drifts which are normally covered with ice. Also ore can be pulled from colder parts of the mine.

Silver Shield Mining and Milling Company and the Colvin Mining and Milling Company have signed a lease which they say assures operation of the new Silver Shield mill, located near Ouray, Colorado. The mill is operating on a six-day-a-week basis. Ore is to be supplied from properties of the Altoona group of mining claims in Yankee Boy Basin where mining and development operations are underway. The Iron Magnet and the Harry C. group of eight claims, located near Silverton, are included in the development program. Additional machinery will be installed at the latter operations to facilitate mining. Tom Colvin, superintendent of the Colvin Company and Louis Stein of Silver Shield, signed the lease.

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## ROCKY MOUNTAIN PRECIPITATES

Three men have staked claims covering an area of approximately 1,500 acres of native sulfur deposits in the Lone Cone mining district, Dolores County, Colorado. William Thomas of Delta, Colorado, and Gifford and Dean Allen of Hotchkiss, Colorado, plan to develop a portion of their placer claims which cover sulphur outcroppings on the sides of Bull Gulch and in the stream beds. They have bulldozed the area to explore and to determine the amount of sulfur present.

cers include Ed Lowman, secretary, and Roland Cox, Darrell Free, and Victor Cottino, directors.

A reconnaissance party is prospecting for uranium ore in Utah's *Uintah Basin* for the U.S. Atomic Energy Commission. One wagon drill is working, but thus far, no significant discovery has been made. Some drilling is on fee or private land in the basin. Further work will depend on geological results obtained by the party operating out of Vernal, Utah. In the past, a carnotite-type ore has been found in the Wasatch formation in the Myton area of Uintah County.

G. S. Ziegler & Company of New York is planning to operate properties recently purchased from the *American Asphalt Association* of St. Louis, Missouri, and the *Castle Peak Gilsonite Company*, of Provo, Utah. These properties include American Asphalt's mines at Little Bonanza, Uintah County, Utah, and Castle Peak's holdings in the Bonanza area and its pulverizing and packing plant at Provo. With its new acquisitions and the mines of the Utah *Gilsonite Company* in Uintah Basin which it purchased last year, Ziegler is reported to have reserves of more than 2,000,000 tons of gilsonite.



A phosphate lease at Rex Peak, northern Utah, will soon be in production, according to J. R. Simplot who purchased it from W. H. H. Granmer and John Archer of Salt Lake City, Utah. Phosphate rock will be used in a treble superphosphate fertilizer plant in Pocatello, Idaho which Mr. Simplot recently started operating. Under terms of the sale, the sellers will get a 10 percent over-riding royalty on acid-grade rock, a 5 percent royalty on electric furnace grade rock, and an additional \$25,000 during the next few years.

*Kennecott Copper Corporation's Utah Copper Division* has reached an agreement with Mine-Mill locals at Bingham and Magna, Utah. The two-year contract, containing a reopener clause on economic provisions for June 30, 1954, became effective on July 1. The contract provides for a general wage increase of 8.5 cents per hour which became effective on August 1, and 4.2 cents per hour increase which became effective on July 1, in settlements of inequities claimed by the union and based on the difference in past wage agreements. In effect, the 4.2 cent increase brings existing rates for Mine-Mill into "equalization" with the Steelworkers Union.


*New Park Mining Company* is undertaking an exploration program for uranium ore. *New Park and Oil, Inc.* of Salt Lake City have acquired extensive holdings of potential uranium-bearing lands in San Juan County, Utah. The properties include 6,400 acres of mineral leases between LaSal and Monticello, Utah, and 16 uranium claims near Grandview Point, Utah. The holdings were obtained largely from the *Mid-West Uranium Company* of Denver, Colorado. Two drilling rigs are being moved to the Grandview Point claims for diamond drilling. About two miles of road will be built into the area.

*Blue Star Mining Company* will soon have a 40- to 60-ton mill valued at \$50,000 in operation at its tungsten mine in Mineral Range near Beaver, Utah. Property is leased from Tattersall, Lessing, Murdock, Cutler, and others. Power for the mill is furnished by the *Telluride Power Company*. The government will buy all concentrates from the mill for three years. The firm reportedly has about 3,000 tons of 7.0 percent tungsten ore ready for mining and milling. Lory Free is president of the firm. Other offi-



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## precipitates—NORTHWEST

### Hanna's Nickel Smelter To Start Next September

Hanna Nickel Smelting Company expects to start pouring ferronickel from one furnace at its smelting plant near Riddle, Oregon before September 30 of next year. The remaining three furnaces will be installed by the end of 1954.

Bechtel Corporation has been awarded the contract to construct the smelter, which will be located two miles from Nickel Mountain where Hanna is developing an open-pit mine. An 8,570-foot aerial tram will carry low-grade laterite from the mine to the smelter.

Operations have begun under the direction of D. N. Vedensky, director of M. A. Hanna's research and development department; E. Mollard, manager; and H. G. Schoenike, superintendent of Hanna Nickel Smelting Company.



A \$63,700 lead-zinc exploration project at Gilmore in Lemhi County, Idaho is planned by Roger Pierce of Salt Lake

City, Utah. He has been granted a DMEA loan for half the proposed expenditure. His application was made before the May 15 deadline for accepting zinc-lead loan applications.

*Idaho Custer Mines, Inc.*, which also beat the deadline, has been granted a loan of \$48,868.80 for underground zinc-lead exploration at the *Livingston* mine in Custer County, Idaho. The company must match the loan.

*Sunshine Mining Company* is opening its main silver vein from a new 3,850-foot level off the No. 5 winze and completing preparations to open the vein at the 4,000-foot horizon also. Previous deepest production from the *Sunshine* vein was from 3,700-foot workings off the *Jewell* shaft. The property is in the *Evolution* mining district east of Kellogg, Idaho. R. D. Leisk is general manager.

In the adjoining *Silver Syndicate, Inc.* property, *Sunshine* is diamond drilling from a 3700-level crosscut to test the *Silver Syndicate* fault-vein which was well-mineralized with galena where intersected midway between present producing areas. Six stope are in regular production with grade running 21.8 ounces of silver and 4.6 percent lead to the ton, compared with 19 ounces of silver and 3.65 percent lead in 1952. Output has averaged about 4,000 tons monthly

this year. W. M. Yeaman of Yakima is president.

Shaft deepening crews at *Bunker Hill & Sullivan Mining and Concentrating Company's* *Crescent* mine east of Kellogg are making 200 feet a month. Deepening of the shaft from the 1200-foot level to the 3,200-foot horizon was started late in June. The DMEA is loaning the company half of the estimated \$1,098,750 cost of the below sea-level lead-zinc-copper exploration project. J. B. Haffner of Kellogg, Idaho is general manager for *Bunker Hill*.

In an effort to offset lowered income resulting from the lead price drop, another Coeur d'Alene silver company, *Lincoln Mining Company*, is curtailing overhead expenses. Its new president, C. J. Hamilton of Coeur d'Alene, cut his own salary one-third, substituted the mails for long-distance telephone and telegraph service, and replaced eastern accountants with local ones.

*Lucky Friday Silver-Lead Mines* is mining and milling about 80 tons of ore daily at its property in the *Hunter* district east of Mullan, Shoshone County, Idaho. At the same time, crews are opening a new 2,300-foot level and driving an exploration crosscut northerly towards adjoining ground of *Hunter Creek Mining Company*, in which *Lucky Friday*



### TUNGSTEN VENTURES IN STEVENS COUNTY, WASHINGTON

Blue Grouse Mountain in northeastern Washington is the scene of renewed mining activity these days with exploration and development programs under way on two sides of its slopes. *Sunshine Mining Company*, operator of the *United States'* largest silver mine located in the Coeur d'Alene mining region of Idaho, has started a second tungsten exploration program on 80 acres of state-owned land on the south side of Blue Grouse Mt. (Earlier this year *Sunshine* leased the Storm Lake tungsten property in Deer Lodge County, Montana.) *Sunshine* has a half interest in the lease and W. H. West of Deer Park, Washington, holds the remaining interest. Mr. West supervises the crew, some of whom can be seen digging out the portal for the adit in the picture above, left. The *Little King* tungsten mine, as it is called, is at an elevation of 3,700 feet. The new adit has been started below a *Sunshine* bulldozer cut which exposed four parallel veins of huebnerite, hematite, and mica near a granite-

quartzite contact. A portable Diesel air compressor and a jack-leg drilling machine will be used in initial work. A compressor house, cookhouse, and bunkhouse are planned. Operations are under the direction of Rowland King, *Sunshine's* exploration engineer with headquarters in Spokane. *Big Q Tungsten Mine, Inc.* of Seattle, successor to *Pacific Mining Company*, is developing the old *Deer Lake* tungsten property on the north side of Blue Grouse Mt. Nearing completion is a raising and drifting project from the 600-foot main adit to connect with the old water-filled shaft workings. In the center photograph, miners Frank Trampush and Bob Brash may be seen emerging from the adit. The photograph at the right shows the old mill on the property which is being modernized. Improvements also include a compressor house, two cabins, an office, and a cookhouse. William M. Quigley is company president and treasurer; E. M. Weston is vice president.

## NORTHWEST PRECIPITATES

has a half interest. Mike Sekulic of Mullan is company president.

**Silver Star-Queens Mines** is working on plans for a concentrator at its Blaine County, Idaho property. Five cars of ore were shipped recently from the firm's *Queen of the Hills* mine. At the company's *Minnie Moore* mine, an inclined raise from the west lateral has connected with old workings and rehabilitation work is under way.

A third ore shoot has been opened by **Whitedelf Mining and Development Company** in exploration work on the new 800-foot level of its *Whitedelf* mine near Clark Fork, Bonner County, Idaho. The lead-silver discovery was in a section of the Pearl vein barren on the 400-foot level. Compton I. White Jr. is manager.

**Sidney Mining Company** is deepening its main shaft from the 1300 level to open a new 1500 level. Exploration is continuing in the northern part of the firm's property in the Pine Creek district of the Coeur d'Alene mining region on the No. 5 level. W. T. Simons of Kellogg, is president.

**Day Mines, Inc.** of Wallace, Idaho has started opening a new 1,600-foot level in its *Hercules* mine at nearby Burke after deepening the main shaft to the 1,680-foot point. The work will test the downward extension of the West Hercules ore body discovered in 1950 on the 1000 level after unwatering of the long-idle mine and followed by a winze for 300 feet. It also will determine whether the main Hercules ore body actually bottomed at a 400-foot higher horizon as presumed after it had yielded more than \$80,000,000 worth of lead-silver ore.

**Edith Murray Mining Company** has uncovered a vein of lead carbonate in bulldozing at its property near Murray, Idaho. Vincent Buck of Spokane is secretary. Richard D. Riegel of Spokane has relocated part of the old *Murray Consolidated* group of claims south of the Edith Murray and renamed them the *Liberty* group.

**Silver Buckle Mining Company** has concluded an agreement with *Vindicator Silver-Lead Mining Company* for exploration of the three-claim *Vindicator* property near Mullan, Shoshone County, Idaho for half of ore found. Plans call for sinking an 800-foot shaft and extensive lateral work therefrom. Silver Buckle also has acquired a stock interest. Dr. F. E. Scott of Wallace is president of Silver Buckle.

Encouraging results have been obtained by **Northfield Mines, Inc.**, of Eureka, Nevada, from a cobalt-copper exploration program started in the fall of 1951 at the *Stevenson* property in Lemhi County, adjacent to *Calera Mining Company's Blackbird* mine. Three mineralized zones have been exposed on the surface and one has been partially explored underground. Development includes 11,000 feet of surface trenching, 4,000 feet of diamond drilling, and 850 feet of crosscutting and drifting. George W. Mitchell is general manager. Milo Manz is in charge of work at the property.

The **South Mountain Mining Company** operating at South Mountain in southern Idaho is shipping copper-lead ore to *American Smelting and Refining Company's* Garfield, Utah copper smelter. The company is continuing its intensive exploration program and has delimited

a number of both copper-lead and zinc-copper ore-bearing chimneys in limestone. H. F. Anderson of Jordan Valley, Oregon, is manager.

MONTANA

**Golden Anchor Mining and Milling Company** has been granted an \$18,858 DMEA loan for a \$37,716 lead-zinc exploration project at its *Big Dick* mine in the Elliston district, Powell County, Montana. The firm's application was made before the May 15 deadline. H. L. Newmiller of Elliston is company president.

The **American Chrome Company's** gravity concentration mill has started to concentrate chrome ore from the *Mouat* mine near Nye, Montana. Approximately 500 tons per day are being treated now, with ultimate capacity expected to be about 1,000 tons of ore per day. Some stockpiled ore, together with mine ore, is now being transported from the mine by aerial tramway to the mill.

**Nancy Lee Mines, Inc.** is planning lower level exploration of a copper-silver ore body mined many years ago from the surface to a depth of 245 feet at its Mineral County, Montana property. Surface soil sampling, bulldozing, and diamond drilling also are planned. A lead-bearing ore body disclosed by diamond drilling recently below the 640-foot level now is being mined under working lease contract on a 15 percent royalty basis. Wendell R. Brainard of Kellogg is company president.

The **American Chrome Company** has started underground development and production of chrome ore at its *Mouat* mine in Montana. Delay in installation of air compressors slowed underground production but mining operations are now underway under the direction of John Bley, manager. The mine was initially developed by the *Anaconda Copper Mining Company* acting as agent for the government during World War II.

**Montana Exploration and Development Company** is currently stripping the

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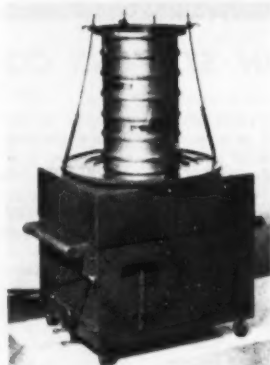
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overburden from a low-grade zinc vein reported to be 40 feet wide, on the firm's property nine miles east of Hall, Montana. Plans call for construction of a mill, and mining by open-pit methods.

A small differential flotation mill is being constructed at the *Consolation* lead and zinc mine site in the Heddleson district 20 miles east of Lincoln, Montana.



Bob Radcliffe and Al Lea have shipped nearly 50 tons of chrome ore, none assaying less than 52 percent Cr<sub>2</sub>O<sub>3</sub>, since they started operations at their *Lucky L & R* claim north of Chrome Ridge, Josephine County, Oregon. A half mile of access road was completed to the property last spring and mining began in July. The two partners are also mining some low-grade ore which is being stockpiled at Radcliffe's mill located at his *Black Bear* gold mine about three miles northwest of Galice. At the L & R claim, open cuts have exposed disseminated and some high-grade chrome in discontinuous narrow stringers over a distance of about 120 feet.

The Six Mile Creek mill, owned and operated by Messrs. Floyd, Pressler, and Jackson, is now milling chrome ore from the *Jackson Creek* mine. The mill was built this spring at the mouth of the Six Mile Creek about 8 miles west of Selma, Josephine County, Oregon.

The *Sad Sack* chrome property has been leased by Lou and Bill Robertson from C. O. Russell and C. O. Anderson. Formerly the *Black Prince*, the property is in Josephine County, Oregon. Nearly 300 feet of tunnel have been driven about 60 feet below the open-pit work done last summer and the Robertsons are now mining a stringer of high-grade ore which may be an extension at depth of a pod mined near the surface. Bill Robertson, together with some associates, has also leased the *Jim Bus* mine on the southwest side of the Illinois River in Josephine County. An inclined shaft is being sunk alongside a diorite dike containing chromite.



*Consolidated Mines and Smelting Company, Ltd.* is spending about \$6,000 this year in developing its *Silver Ridge* property west of Keller in Ferry County, Washington. Three old workings were unwatered. Hugh Brown of Keller is company president.

*Northport Operating Company* has exercised an option to purchase eight mining claims in northeastern Stevens County, Washington from *Frisco Standard Mining Company* for \$30,000. U. E. Chamberlain of Olympia heads the firm purchasing the one-time lead-zinc producer.

*Pacific Northwest Alloys, Inc.* has started producing ferrochrome at a rate

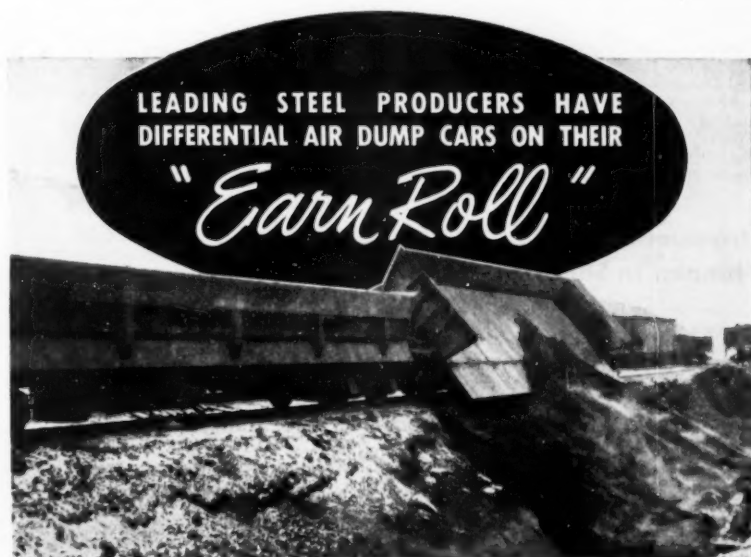
OCTOBER, 1953

of about 1,500,000 pounds monthly at the former *Mead* magnesium plant north of Spokane, Washington. The firm leased the plant from the government recently after its contract for producing magnesium was canceled. H. B. McGill of Spokane is executive vice president and general manager.

*Silver Dollar Exploration and Development Company* of Spokane, Washington has been organized to carry on prospecting for uranium and other metals in Idaho, Montana and British Columbia. Elmer E. Johnston, president of *Silver Dollar Mining Company*, a Coeur d'Alene mining region producer, heads the new firm. M. W. Austin is vice president and J. R. Merriman, secretary.

*Washington Non-Metallics, Inc.* of Chewelah, Washington, plans to boost output of marble products from 40 tons to 150 tons a day with installation of new equipment. A 40 by 100-foot warehouse is being constructed at the present plant. The structure will have concrete walls and floors, with a quonset-type roof. Gordon LaVigne is company vice president.

William and Richard Weaver of Spokane, Washington have purchased the *United Treasure* mine in northern Stevens County, near the Canadian border, from R. O. Reinertsen, Seattle. They have cleaned out an old tunnel and started stoping silver ore by hand until machinery is obtained.



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### El Paso, Texas Is Scene Of Oct. 28-31 Meetings

The annual meeting of the New Mexico Mining Association and the regional meeting of the American Institute of Mining and Metallurgical Engineers will be held in El Paso, Texas on October 28-31 in conjunction with El Paso's International Mining Days celebration.

Speakers already on tap for the meetings are Felix Wormser, Assistant Secretary of the Interior for Mineral Resources, and Congressman Ken Regan of Texas.

Hotel reservation requests should be sent to Ted Lind, Chairman, Hotel and Housing Committee, c/o El Paso Chamber of Commerce, 310 San Francisco Street, El Paso, Texas.

### Uranium Processing Plant Planned In Shiprock, N. M.

Construction has begun on a \$3,000,000 uranium processing plant at Shiprock, New Mexico by Kerr-McGee Oil Industries, Inc. under operational contract with the United States Atomic Energy Com-

mission. The Navajo tribe has leased the ground for the plant and for an accompanying housing project that will be built nearby. Actual milling of the ore is scheduled to begin in 1954.

The new plant, expected to stimulate the production of uranium ore in Arizona, New Mexico, and Utah, will provide several hundred jobs for the members of the Navajo tribe. The AEC has operated a sampling plant at Shiprock for two years and ores produced in the Lukachukai Mountains in the northern part of the Indian reservation have been stockpiled pending construction of a processing plant.

Navajo Uranium Division of Kerr-McGee will operate the plant, as well as construct it. Clyde Osborn, manager of operations, is in charge of mining and milling activities, and G. R. Kennedy is manager of exploration.

Execution of this contract increases to a total of 10 the number of uranium ore processing plants either in operation or under construction in the Colorado Plateau area. Operating plants include: the United States Vanadium Corporation's at Rifle, Colorado, and Uravan, Colorado; Vanadium Corporation of America's at Naturita, Colorado, Durango, Colorado, and Hite,

Utah; the Atomic Energy Commission's at Monticello, Utah; Climax Uranium Company's at Grand Junction, Colorado; and the Vitro Chemical Company's at Salt Lake City, Utah. Anaconda Copper Mining Company has a plant nearly finished at Bluewater, New Mexico to treat limestone-type ores mined in northwest New Mexico. A unit to treat sandstone type ores may be incorporated at a future date.

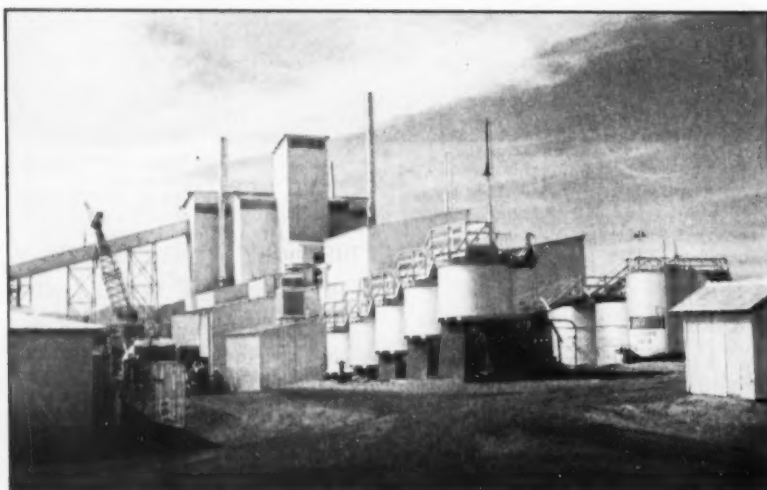
ARIZONA

Newmont Exploration, Ltd. has established offices in Tombstone, Arizona where it is exploring 92 claims held by the Tombstone Development Company. Initial exploration reportedly will be centered around the old *Lucky Cuss* and *West Side* mines which would have to be dewatered before any diamond drilling could proceed. Don Hargrove is the engineer in charge of these operations.

The *Phelps Dodge Refining Corporation*, a wholly owned subsidiary of *Phelps Dodge Corporation*, has signed a ten-year contract with *San Manuel Copper Corporation* to refine copper from the firm's mines at Superior, Arizona. Production at San Manuel is expected to get under way in 1956, at the rate of about 70,000 short tons of electrolytic copper annually. San Manuel is a wholly owned subsidiary of *Magma Copper Company*, *International Minerals & Metals Corporation* which handles the sale of some 25,000 tons of electrolytic copper annually for Magma, has been appointed sales agent for San Manuel copper.

The *Holmestake Mining Company* of Yuma, Arizona has converted the old Holmes mill at Winterhaven, California for the treatment of lead-fluorspar ore. The mill will treat 125 tons of ore per day from the tailings of the old *Castle Dome* mine, 25 miles north of Yuma. The tailing alone is expected to keep the mill in operation for about three years, after which the company plans to reopen the mine. The firm is now shipping two 75-ton *ore* loads of acid-grade fluorspar weekly. Shipments are divided between the *Kaiser Aluminum and Chemical Corporation* plant in California and *Nilotex Chemical Corporation* at Houston, Texas. Lead production is at the rate of one ton per day with shipments going to the *American Smelting and Refining Company* plant at El Paso, Texas for refining.

*United Minerals Corporation* of Salt Lake City, Utah has reported a discovery of copper ore in the *Sunnyside* group of claims operated with Lee Ferrell near Patagonia, Arizona. Cuprite and malachite ores testing as high as 50 percent copper in places have been located. There are also one or two showings of good-quality galena lead ore, and some payable amounts of silver and gold. According to George W. Snyder, Jr., president of the firm, the "pipe's" dip has been followed



### BUREAU OF MINES MANGANESE RESEARCH

The hydrometallurgical building at the Southwest Experiment Station of the U.S. Bureau of Mines, Boulder City, Nevada, is pictured above. This plant and a flotation pilot plant were built to continue development work and to prove laboratory procedures already devised at Salt Lake City and Tucson for treating low-grade manganese ore from the Artillery Peak district of Arizona. The United States Geological Survey estimates this deposit to be one of the country's largest, containing a minimum of 175,000,000 tons of marginal and submarginal material. Of this total, about 15,000,000 to 20,000,000 tons are believed to contain 5.0 percent or more manganese, and more than 2,000,000 tons are estimated to be of 10.0 percent grade or better. About 3,500 tons of this Artillery Peak ore were trucked to Boulder City and stockpiled for investigation of low-cost extraction methods. The flotation plant treated 25 tons of the ore daily until the stockpile was exhausted. The hydrometallurgical plant has been processing products from the flotation plant continuously since that time. In the photograph, the tanks at the right are for storage; those in the center are thickeners for counter-current decantation system; and the conveyor atop the steel framework, left, brings raw materials into the hydrometallurgical building.



for about 90 feet and the limits of the orebody have not yet been established. The discovery, in an andesite porphyry formation, is located in the area where previous mining of lead, zinc, and copper was conducted. The workings were near abandonment a year ago and work had all but ceased when the new discovery was made.

Shattuck Denn Mining Corporation reports that because of the low market prices for lead and zinc, output at its Iron King mine at Humboldt, Arizona during the first six months of this year was reduced slightly to a rate permitting the lowest operating costs. As of June 30, sinking of a new shaft and necessary installation of mining and milling equipment was approximately two-thirds completed. The original plan had been to finish this project by January 1, 1954, but the conditions of the lead and zinc market caused curtailment of the rate of expenditure for such new facilities.

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NEVADA

Black Rock Mining Corporation is producing approximately 300 tons of tungsten ore per day at its Lincoln mine at Tempiute, Nevada. Ore is being mined on the 100 and 300 levels by shrinkage stoppage methods. An ore pass is being driven from the 100 to 300 levels. When this is completed, all mine ore will be taken out by way of the 300 level where an adit was recently driven to be used as the main haulage way. Ore bins are now being constructed at the 300 portal. From here the ore will be trucked approximately one mile to the company's mill. Flotation and gravity methods are used in the mill to recover scheelite, fluor spar, molybdenum, and zinc. Diamond drilling is now being done on the 200 level to prospect for ore between the 100 and 200 levels. Approximately one mile south of the present mine workings, an adit has been driven into the side of the mountain to intersect the same vein structure. Prospect drifts are now being driven along the vein in hopes of finding additional tungsten ore.

Utah Construction Company is investigating a large-scale dredging operation of placer gold just south of Rawhide, Mineral County, Nevada. Two field crews have completed preliminary surveys and tests in the area. Power would be brought in from Gabbs, Nevada if development plans are carried out. Rawhide is noted for its past production of lode gold.

Kaiser Aluminum & Chemical Corporation, after cutting back on its working force at the Kaiser mine, continued development work on the 600-foot level and discovered an important body of ore along the strike of the existing fluor spar occurrence. This ore is mined by stoping to the 400-foot level. The Kaiser mine is in Mineral County, five miles west of Broken Hills, Nevada. Ore is trucked to Fallon where it is concentrated at Kaiser's mill.

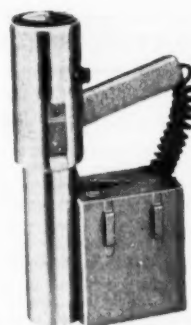
Tonopah Development Company currently plans to drift on its silver-gold vein at the 250 level in two directions—east and west. The vein is about four feet across at the point where it was recently tapped by a 14-foot crosscut extending from the winze. If the mine lives up to expectations, a raise will be driven from the top of a winze to the surface to provide a full length working shaft, and a cyanide treatment plant will be installed to treat the silver ore. The company is developing the Summit King property north of Tonopah, Nevada. Calumet and Hecla Inc. owns the property which is leased to the Homestake Mining Company and Summit King Mines Ltd. who are participating jointly in the operation as the Tonopah Development Company.

Winnemucca Mountain Mines Company of Winnemucca, Nevada reports that its tungsten milling plant has started test runs and is producing about 200 pounds of tungsten concentrate per day. The firm has converted its pilot mill to a 50-ton mill and added a concentrating table flotation cell, and jig. Officers of the firm are O. R. Maunula, president; William D. Craft, vice president; Gus Rogers, secretary-treasurer; Clifford Anser and E. S. Williams, directors.

The Blue Diamond Corporation at Blue Diamond, Nevada, is currently shipping

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About 15 tons of scheelite is being produced daily from the Ray Pickett mine operated by the Nevada Pacific Development Corporation, also in the Gabbs district of Nevada. Stanley Chiatovich is superintendent.

The Metallurgical Development Company, which purchased a mill from the Alpine Mining Company several months ago, is now treating from 50 to 75 tons of ore per day from shippers in Douglas County. The mill is a combination gravity and flotation operation. Among the shippers to Metallurgical Development's mill are Clyde Lovestead who is developing a claim near Garderville, and Don Burgner, who recently leased the Alpine mine in the Pine Nut area. Joe Morris of Garderville is president of Metallurgical Development Company.



Eddie Simon and three other miners are reported to have made a silver strike in the long-abandoned Silver Cell mine near Pinos Altos, 10 miles north of Silver City, New Mexico. The discovery reportedly caused a rush for leases in the area which produced high-grade gold and silver ore 50 years ago. During recent years, prospectors have been reworking large mine dumps.

The New Mexico Copper Corporation is in full swing at its Conqueror mine in the Gallinas Mountains near Carrizozo, New Mexico. The mine's main shaft has been sunk to a depth of 210 feet, exposing numerous veins of ore, carrying values

in copper, lead, wulfenite, and fluor spar. Work of deepening the shaft to the 220 level is nearly completed, and drifts have been started at the 135-foot level. A total of 62 feet of ore has been exposed in the northwest drift at the 135-foot level and 8 feet in the north drift.

Shattuck Denn Mining Corporation has discontinued work on the uranium property it has been exploring north of Blue Water, New Mexico, pending negotiations for an improved lease from the owners of the property. The area is near Santa Fe Pacific Railroad Company's Haystack Mountain operation; however, the Shattuck Denn deposit is in sandstone-type ore in the Morrison formation. The company's fluor spar division near Los Lunas may close its mill until an increased demand for fluor spar justifies its reopening. Since July the demand for output from the fluor spar concentrating mill has declined drastically.

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#### NEW MERRICK WEIGHTOMETERS

- 7 Type E for 24", 30", 36" & 42" Belt.

#### SYNG. MOTOR GENERATORS

- 2 - 500 KW WESTGH 1200 rpm 4160/2300 - 275 V
- 3 - 150 KW G.E. 1200 rpm 2300 - 275 V
- 1 - 100 KW RIDGEWAY 1200 rpm 2300 - 275 V

#### TUNNEL SHOVEL LOADERS

- 13 Elmo 12B - 21 - 21.56 - 40 - 102

#### DIAMOND DRILLS

- 3 Sullivan 500 ft. & 1500 ft. ROD CAP.

#### ELEC. MINE HOISTS

- 25 Single Drum 60 H.P. & 100 H.P.
- 150 H.P., 260 H.P., 600 H.P. & 1300 H.P.
- 19 Double Drum 75 H.P. & 125 H.P.
- 150 H.P., 400 H.P. & 500 H.P.
- 9 Cylinder Conical 100 H.P., 350 H.P., 800 H.P., 1000 H.P. & 1400 H.P.

#### ELEC. AIR COMPRESSORS

- 3-950 ft. Joy WN112E 150 H.P. 2300 V New 1949

In West.

1888 ft. Chgo. Pneu. 350 H.P., 2200 V

3000 ft. Chgo. Pneu. 500 H.P., 2200 V

676 ft. Worthing 125 H.P. 220/440 V

#### LOCOMOTIVES

- 45 ton G.E. Diesel Elec.
- 20 ton Whitcomb Gas
- 5 ton Plymouth Gasoline
- 6 ton Brookville Diesel
- 4 - to 6 ton Jeffrey Battery
- 9 - 4 ton, 6 ton, 8 ton Goodman Trolley

#### CRUSHERS

- 2 Buchanan C Sectional 30 x 42.
- 14 Jaw 13x24, 13x30, 18x36 - 24x36 - 10x36
- 42x48 and 48x60

2 Model 322R & 636 R Allis-Chalmers Reduction

1 Traylor 3 ft. TY Reduction

#### BELT CONVEYOR IDLERS

3075 New 36 in. 42 in., 60 in.

Troughing and Return Type.

#### TUBE, ROD & BALL MILLS

- Hardinge Conical Mills 5'x22", 6'x22", 6'x36", 8'x30", 10'x36" & 10'x48"
- 2 - 5'x18" Tube Mills, Mang. steel lined.
- Rod Mills 3'x10", 4'x7" & 5'x14"
- Cylindrical Ball Mills 3'x7", 4'x5", 5'x6", 6'x6", 6'x10", 7'x6", 8'x6" & 9'x11"

#### CLASSIFIERS & THICKENERS

- Dorr 3'x25'x10 Turret Bowl
- Dorr 6'x22' DSF Rake & 2'x15' SSFR
- Atkins 54" & 60" Classifier
- Dorr 40'D.x30' - Three Tray, 4 Comp. Thickener
- Hardinge 6'x14' Counter Current Classifier

#### SPECIALS

- 8 1/4' - 10' - 8 1/2" x 50" Nodulizing Kilo
- Dinga 3-Roll 60" Type IR Mag. Sep.
- Manganese Sulphate Recovery System.

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- 1-Pagregan Single cell
- 1-6 cell 18" Stearns-Roger
- 2-6 cell Denver "Sub A" #21

### FILTERS

- 1-6' 2-disc American Filter
- 1-6' 3-disc American Filter
- 1-10" Morse Round Pattern Filter Press
- 1-36" Merrill Triangular Filter Press
- 1-12# Sweetland Filter Press, 36 leaves

### BALL & ROD MILLS

- 1-4' x 4' Colo. Iron Works Ball Mill
- 2-6' x 48" Hardinge Conical Ball Mills with air swept equipment
- 1-8' x 22" Hardinge Conical Pebble Mill
- 1-3' x 8' Marcy Rod Mill

### TUGGERS AND SLUSHERS

- 1-Ingersoll Rand, model 6HC Single Drum Air Tugger
- 1-5 H.P. Brownie, Single Drum Electric Tugger
- 1-5 H.P. Sullivan Single Drum Electric Tugger
- 1-7 1/2 H.P. Sullivan Double Drum Electric Slusher
- 2-10 H.P. Sullivan Three-Drum Electric Slushers
- 2-6 1/2 H.P. Sullivan Single Drum DC Electric Tuggers
- 5-6 1/2 H.P. Sullivan Double Drum DC Electric Slushers
- 1-10 H.P. Sullivan Two Drum driven by Continental 4 Cyl. Gas Engine.

### SLIP RING MOTORS

- 1-20 H.P. G.E. 3/60/440, 720 RPM
- 1-30 H.P. G.E. 3/60/440, 1145 RPM
- 1-37 H.P. G.E. 3/60/440, 600 RPM
- 1-40 H.P. Westinghouse 3/60/440, 900 RPM
- 1-50 H.P. G.E. 3/60/440, 900 RPM
- 1-75 H.P. G.E. 3/60/440, 900 RPM
- 1-100 H.P. G.E. 3/60/440, 430 RPM
- 1-112 H.P. G.E. 3/60/440, 720 RPM
- 1-125 H.P. Westinghouse 3/60/440, 900 RPM
- 2-150 H.P. Allis Chalmers 3/60/440, 900 RPM
- 2-165 H.P. G.E. 3/60/440, 450 RPM
- 1-200 H.P. G.E. 3/60/440, 450 RPM
- 2-50 H.P. G.E. 3/60/2300, 900 RPM
- 1-250 H.P. G.E. 3/60/2300, 450 RPM
- 1-300 H.P. G.E. 3/60/2300, 485 RPM

### LOCOMOTIVES

- 1-2 1/2 ton Whitcomb Battery, 24" gauge
- 1-2 1/2 ton Jeffery battery or trolley, 36" gauge
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- 1-4 ton Ironton battery, 36" gauge
- 2-7 ton General Electric permissible battery, 36" gauge
- 1-7 ton Atlas battery, 36" gauge
- 3-8 ton Ironton battery, 36" gauge
- 2-8 ton General Electric battery, 36" gauge
- 4-10 ton Atlas battery, 36" gauge
- 1-3 ton Whitcomb gas engine driven, 24" gauge
- 1-4 1/2 ton Goodman trolley, 36" gauge
- 1-5 ton Jeffery trolley, 36" gauge
- 1-6 ton Goodman trolley, 36" gauge
- 2-8 ton Goodman trolley, 36" gauge

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- 2-88 CFM Ingersoll-Rand, 7" x 5"
- 1-121 CFM Gardner-Denver, 8" x 6"
- 1-173 CFM Chicago-Pneumatic, 9" x 6"
- 1-173 CFM Ingersoll-Rand, 9" x 8"
- 1-179 CFM Ingersoll-Rand, 12" x 10"
- 1-213 CFM Blaisdell, 14" x 9" x 8"
- 1-230 CFM Gardner-Denver, 6" & 4 1/4" x 5"
- 1-447 CFM Ingersoll-Rand, 14" & 7 1/2" x 12"
- 1-637 CFM Sullivan, 14" & 8 1/4" x 10"
- 1-698 CFM Union, 16" x 12"
- 1-900 CFM Ingersoll-Rand 16" & 11" x 16"
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- 1-9" x 15" Farrell Jaw Crusher
- 1-9" x 16" Universal Jaw Crusher
- 1-8" x 24" Rogers Jaw Crusher
- 1-8" x 36" Universal Jaw Crusher
- 1-11" x 18" Universal Jaw Crusher
- 1-24" x 13" Farrell Jaw Crusher
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300 H.P., 1½" rope, 5'6" dia., 4' face.  
350 H.P., 1½" rope, 7' dia., 6' face.  
400 H.P., 1½" rope, 7' dia., 7' face.  
800 H.P., 1½" rope, 7' dia., 5' face.  
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500 H.P., 1½" rope, 8' dia., 5' face, clutched.  
600 H.P., 1½" rope, Conical, 1200 ft. clutched.  
900 H.P., 1½" rope, 14' dia., 7' face, clutched.  
1200 H.P., 1½" rope, 9' dia., 6' face, clutched.  
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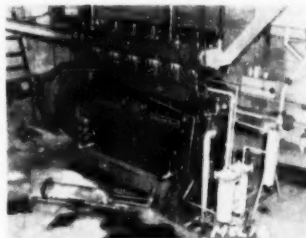
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## INDEX OF ADVERTISERS

Acker Drill Co. ....	99	Edwards Co., E. H. ....	80	Research & Development	
Agence Minière et Maritime	98	Eimco Corp. ....	31	Corp. ....	120
Allen-Sherman-Hoff Pump Co.		Outside Front Cover		Nordberg Mfg. Co. ....	6, 101
Allen-Chalmers Mfg. Co.		Emco Concrete Cutting Co.	102	Ohio Electric Mfg. Co. ....	73
General Machinery Div. 40, 41		Engineers Syndicate, Inc. ....	119	Oliver United Filter ....	38
Allis-Chalmers Mfg. Co.		Euclid Road Machinery Co.	93	O'Neil, A. J. ....	123
Tractor Div. ....	27	Federal Pipe & Tank Co. ....	123	Pacific Foundry Co., Ltd. ....	102
Allison Steel Mfg. Co. ....	123	Flexible Steel Lacing Co. ....	100	(World Mining) ....	
Alloy Steel & Metals Co. ....	21	Galigher Co. ....	22	Pacific Pipe Co. ....	116
American Cyanamid Co. ....	47	Gardner-Denver Co. ....	9	Peale, Rodgers	120
American Manganese Steel Div.		Gates Rubber Co. ....	97	Pittsburg Leetromelt	
American Brake Shoe Co. ....	16	General Electric Co.		Furnace Corp. ....	14
American Potash & Chemical		International ....	26	Precision Radiation	
Corp. ....	112	(World Mining)		Instruments ....	96
American Smelting & Refining		Goodall Brothers	120	Pressed Steel Car Co. WM 36, WM	
Co. ....	102	Hanks, Inc., Abbot A. ....	120	37 (World Mining)	
American Zinc, Lead &		Hardinge Co. ....	91	Price, Franklin L. ....	120
Smelting Co. ....	114	Harnischfeger Corp. ....	2	Republic Supply Co. ....	116, 119
Anaconda Wire & Cable		Havlick Diamond Drilling		Resisto-Loy Co. ....	87
Co. ....	26	Co., Inc. ....	122	Ross Screen & Feeder Co. ....	23
Arizona Testing Laboratories		Hawley & Hawley ....	120	Salem Tool Co. ....	3
Barber-Greene Co. ....	96	Heil Co. ....	87	Sauerman Bros., Inc. ....	100
Beckman Instruments, Inc.		(World Mining)		Sheffield Steel Corp. ....	WM 20
Bemis Bro. Bag Co. ....	92	Hendrick Mfg. Co. ....	82	(World Mining)	
Bennett's Chemical Labora-		Ingersoll-Rand Co.		Simplex Wire & Cable Co.	78
tories ....	120	International Combustion,		Sintering Machinery Corp. ....	7
Bethlehem Pacific Coast		Ltd. ....	22	Smith Co., F. L. ....	44
Steel Co. ....	33	(World Mining)		Smit & Co., Anton ....	102
Black and Deacon ....	120	International Harvester Co.		(World Mining)	
Boyles Bros. Drilling Co. ....	113	(World Mining)		Smith, Paul F. ....	122
Bucyrus-Erie Co. ....	35	International Smelting &		Smith-Emery Co. ....	120
Bunker Hill & Sullivan		Refining Co. ....	114	Sprague & Henwood, Inc.	99
Mining & Concentrating		Johnson, Herbert Banks	98	Stearns Magnetic, Inc. ....	109
Co. ....	114	Keegel, C. P. ....	120	Stephens-Adams Mfg. Co. ....	20
Business Men's Clearing		Kirk Co., Wallace E. ....	123	Still, Arthur ....	120
House ....	123	Kelly, John E. ....	120	Stackwell & Co., W. L. ....	122
California-Texas Co. ....	WM 39	Laylander, Philip A. ....	120	Sturtevant Mill Co. ....	WM 35
(World Mining)		Le Doux & Co. ....	120	(World Mining)	
Card Iron Works, C. S. ....	94	Le Tourneau-Westinghouse		Thermoid Co. ....	77
Caterpillar Tractor Co. 1, 43, 45		Co. ....	24, 25	Thew Shovel Co. ....	28
Chain Belt Co. ....	WM 33	Link-Belt Co. ....	96, 97	Timken Roller Bearing Co. ....	48
(World Mining)		(World Mining)		Thor Power Tool Co. ....	19
Christensen Diamond		Longyear Co., E. J. ....	5	Traylor Engineering & Mfg.	
Products Co. ....	90	Lundberg Explorations, Ltd.	98	Co. ....	13, 17
Coal Mine Equipment		Mace Co. ....	104	Udy, Marvin J. ....	98
Sales Co. ....	121	Machinery Center, Inc.	123	Ultra Violet Products, Inc.	119
Colorado Assaying Co. ....	120	Magma Copper Co. ....	114	Union Oil Co. ....	106
Colorado Iron Works ....	29	Marian Power Shovel Co.	12	United States Rubber	
Columbia-Geneva Steel ....	110	McClintock, R. S. ....	120	International ....	WM 38
Columbian Steel Tank Co. ....	82	Meissner Engineers, Inc.		(World Mining)	
Consolidated Purchasing &		John F. ....	98	United States Steel Co. ....	110
Designing, Inc. ....	122	Merrick Scale Mfg. Co. ....	30	Van Waters & Rodgers, Inc.	120
Cooper-Bessemer Corp. ....	18	Miller, Arnold H. ....	120	Vulcan Iron Works ....	88
Cummins Engine Co. ....	36, 37	Mine Safety Appliances Co.	11	Walvoard Co., O. W. ....	120
Inside Front Cover		Mine & Smelter Supply Co.		Wedge Wire Corp. ....	119
(World Mining)		Inside Back Cover		Western Machinery Co. ....	15
Custom Assay Office ....	120	Morris Machine Works ....	87	Westinghouse Electric	
Darian Corp. ....	121	Morse Bros. Machinery Co.	122	International ....	WM 34
Deister Concentrator Co. ....	96	Murphy, F. M. ....	120	(World Mining)	
Denver Equipment Co. ....	104	Nagle Pump Co. ....	94	Wheel Truening Tool Co. ....	10
Denver Fire Clay Co. ....	92	National Malleable & Steel		Wheeler, Delbert ....	116
Diamond Drill Contracting		Castings Co. ....	32	Wilfroy & Sons, A. R.	
Co. ....	120	National Supply Co. ....	86	Wilfroy & Sons, A. R.	
Dickinson Laboratories ....	120	New World Exploration,		Wilson, Clyde H. ....	120
Differential Steel Car Co.				Wilson, Glenn B. ....	122
Dings Magnetic Separator				Wolf, Harry J. ....	98
Co. ....	4			Wood Assaying Co.,	
Dolores Exploration Co. ....	98			Henry E. ....	120
Dorr Co. ....	84				
Dow Chemical Co. ....	8				

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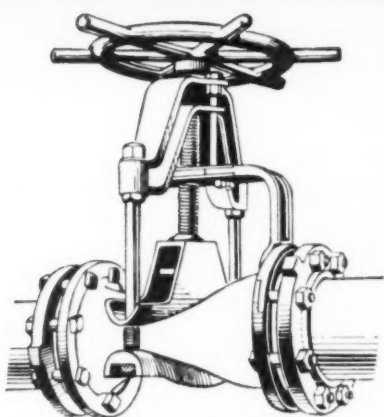
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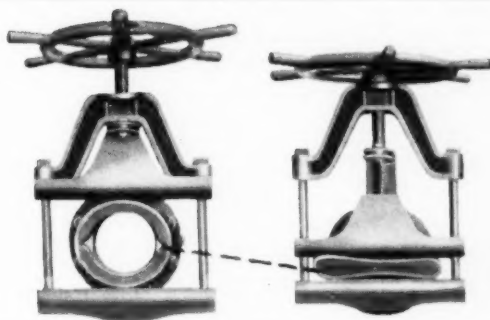
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